

June 2001



# **Integration of Intelligent Transportation Systems (ITS) Into DoD Operations**

**An initial evaluation of ITS intelligent infrastructure technologies and their  
potential value for military deployment**

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## **EXECUTIVE SUMMARY**

### ***An initial evaluation of ITS intelligent infrastructure technologies and their potential value for military deployment.***

In time of war, contingency, or day-to-day operations, DOD must use the national transportation infrastructure. This infrastructure consists of origin and destination nodes and networks of highways, rail lines, and waterways connecting the nodes. For deployment, it is critical this infrastructure is available and access to it is assured.

Recently, concerted efforts have been made by the US Department of Transportation (USDOT), State and local departments of transportation, and other private commercial activities to deploy what has come to be known as Intelligent Transportation Systems, or ITS. ITS represents the next step in the evolution of the nation's entire transportation system. As stated by the Intelligent Transportation Society of America, ITS is "People using technology in transportation to save lives, time, and money." ITS technologies collect, store, process, and distribute information relating to the movement of people and goods. Examples include systems for traffic management, public transportation management, emergency management, traveler information, advanced vehicle control and safety, commercial vehicle operations, electronic payment, and railroad grade crossing safety.

### **ITS Value to DOD**

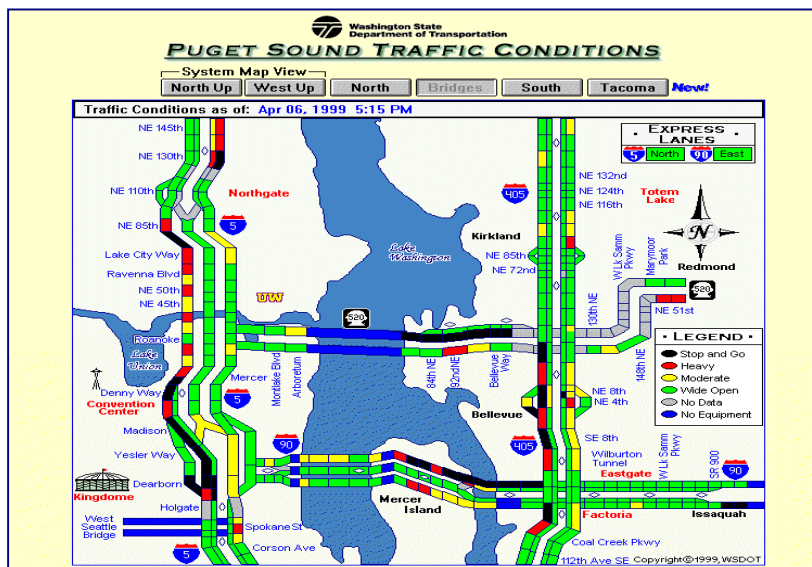
ITS deployment throughout CONUS has resulted in both direct and indirect potential benefits to DOD. Technologies that have value for DOD deployment are intelligent infrastructure, automated vehicle location/identification, commercial vehicle operations, weigh- and measure-in-motion, and intelligent vehicle initiatives, including collision avoidance. This report will focus on the area of intelligent highway infrastructure.

As a primary user of the strategic highway infrastructure, DOD benefits directly from ITS deployment. Numerous USDOT studies have shown that advanced traffic management systems combined with traveler advisory systems ease congestion through densely populated urban areas, consequently increasing the average traffic flow velocity. Deploying units are certainly beneficiaries of more optimized highway transportation systems.

The Intelligent Road/Rail Information System (IRRIS), being developed by the Military Traffic Management Command Transportation Engineering Agency (MTMCTEA), takes DOD from what would be a purely passive role regarding traveler information, to a more active one. By focusing on specific deployment routes and ultimately the whole strategic highway system, IRRIS is able to reduce large volumes of data from a variety of sources and provide immediate access to the essential real-time route information the deploying unit requires.



Traffic congestion, weather events, and highway construction make reliable scheduling difficult and traffic incidents can render even the best schedule useless. IRRIS provides an advance warning of construction and traffic delays and offers alternative routing options. Weather advisory systems in IRRIS provide real-time information concerning high winds, lightning strikes, hail warnings, etc. Tracking capabilities and incident reports in IRRIS offer quick response in the event of on-road emergencies, saving lives and relieving incident-related congestion. With real-time traffic flow information, IRRIS can develop accurate estimated arrival times.



*Real-time construction*

DOD should also continue to support intelligent vehicle, intrasit visibility (especially vehicle tracking), and safety ITS technology developments. One major way to do this is through active participation with ITS associations.



### **Recommended DOD Position on ITS**

DOD should continue to champion research and development in all areas of ITS. Specifically, DOD should:

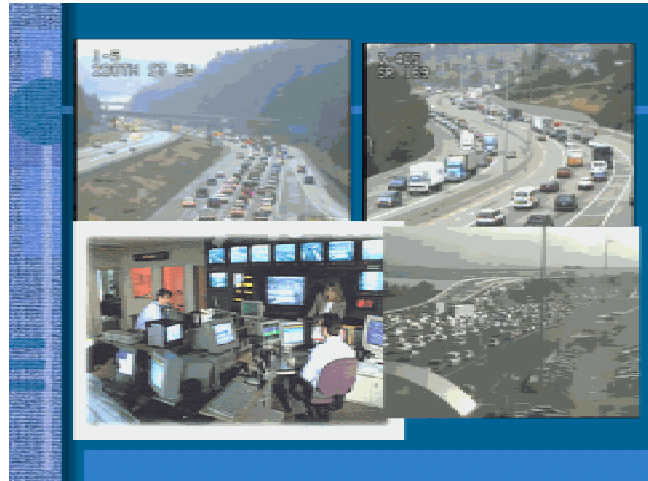
- Continue development of a fully functional Intelligent Road and Rail Information System (IRRIS) capability to aid deployment planners, port operators, and hazardous material coordinators.
- Monitor Federal and State ITS technology development and deployment.
- Participate in the national dialogue on ITS through associations such as Intelligent Transportation Society of America, American Association of State Highway and Transportation Officials, Institute of Transportation Engineers, Transportation Research Board and other national ITS forums.
- Use MTMCTEA as the intelligent infrastructure focal point for ITS. MTMCTEA will coordinate DOD intelligent infrastructure efforts and provide liaison with USDOT and other agencies/associations on ITS.
- Actively pursue the development and deployment of collision avoidance system technology in DOD vehicles through organizations like the National Automotive Center along with public/private consortia.
- Examine integration of ITS initiatives in Automotive Vehicle Location and Identification systems with existing DOD intransit visibility efforts.
- Continue to follow the maturation of weigh-in-motion and remote measurement technologies that DOD can use to develop unit movement data.
- Consider the need to hire motor freight carriers that utilize the latest ITS/Commercial Vehicle Operations (CVO). ITS/CVO user services include electronic clearance, automated roadside safety inspection, on-board safety monitoring, administrative processing, hazardous materials incident response, and freight mobility.

## **BACKGROUND AND PURPOSE**

### ***An initial evaluation of ITS intelligent infrastructure technologies and their potential value for military deployment.***

#### **Background**

In time of war or other contingency, the US Military must use the national transportation infrastructure to deploy from home station locations to sea- and air- ports of embarkation. This infrastructure consists of strategic installations, ports, and networks of highways, rail lines, and waterways. It is critical that this infrastructure is available for deployment, and that access to it is assured. In a broader context, DOD uses the transportation infrastructure for day-to-day operations, including freight movement and access/egress to/from its installations.



Recently, concerted efforts have been made by the USDOT, various State and local departments of transportation, and other private sector commercial activities to deploy what has come to be known as Intelligent Transportation Systems, or ITS. Primarily oriented toward highway infrastructure, the goal of ITS technology is to eliminate congestion, maximize flow and capacity, and increase passenger safety.

National ITS efforts to date have shown a significant benefit in achieving the above goals. Since the US Military relies so heavily on this transportation infrastructure, it is only natural that we assess how DOD can play a more active part in national ITS efforts.

#### **Purpose**

The purpose of this report is to:

- a) Define ITS and its major research areas.
- b) Identify key DOD deployment infrastructure concerns and related ITS technologies.
- c) Provide a snapshot of some current DOD, Federal, and State ITS efforts.
- d) Assess the value to DOD of current ITS intelligent infrastructure efforts as they relate to DOD deployment concerns.
- e) Recommend a DOD position regarding National ITS initiatives.

## WHAT IS ITS?

As stated by the Intelligent Transportation Society of America, ITS is “People using technology in transportation to save lives, time, and money.” ITS represents the next step in the evolution of the nation’s entire transportation system. As information technologies and advances in electronics continue to revolutionize all aspects of our modern-day world, they are also being applied to our transportation network. ITS technologies collect, store, process, and



distribute information relating to the movement of people and goods. Examples include systems for traffic management, public transportation management, emergency management, traveler information, advanced vehicle control and safety, commercial vehicle operations, electronic payment, and railroad grade crossing safety.

There are two concepts central to ITS as it relates to DOD. The first concept is there are items of information that, if gathered and distributed in a timely way, can positively affect how the deployment process functions and its safety. The second concept is information collected and used in ITS can be of benefit to the driver of the vehicle, deployment officials, deployment planners, and the public sector officials responsible for management of the transportation system.

ITS efforts and initiatives can be grouped into four major categories:

- Intelligent Infrastructure
- Intelligent Vehicles
- Public Safety
- Logistics

Intelligent infrastructure is oriented to meeting the transportation needs of metropolitan and rural areas, as well as the commercial trucking industry. Intelligent vehicles focus on safety and information systems for passenger cars, trucks, buses and trains. This report will not discuss public safety and logistics.

## Intelligent Infrastructure

### Metropolitan Area ITS

The goal of a metropolitan area ITS is to manage and operate regional transportation systems to reduce congestion and enhance emergency response. Metropolitan ITS combines several key elements: traffic signal control, freeway management, transit management, incident management, electronic toll collection, electronic fare payment, railroad crossings, emergency response, regional multi-modal traveler information.

The common denominator among all these elements is the achievement of both optimized traffic flow and safety.



### Rural Area ITS

The primary difference between rural ITS approaches and those of metropolitan and commercial vehicle ITS, is the emphasis on safety and collision avoidance through incident reporting and monitoring, and lane-keeping technologies.



Route Guidance and Navigation Systems in personal vehicles can be used to aid drivers in unfamiliar rural areas where directions are often hard to come by. Locational devices can also pinpoint the location of a stolen vehicle.



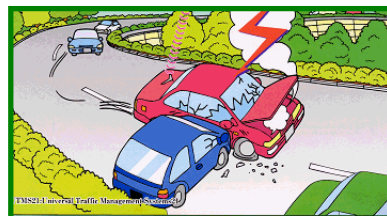
Many rural collisions are animal or tree hits. Vehicle Control and Detection Systems will alert drivers to potential hazards or by taking control of steering or braking functions in the car.

Crashes between cars and trains can be avoided using Railgrade Crossing Systems that alert drivers to approaching crossings and oncoming trains.



When an incident occurs or a car breaks down in a rural area, Mayday and other Cellular-based systems alert authorities of the driver's location and condition.

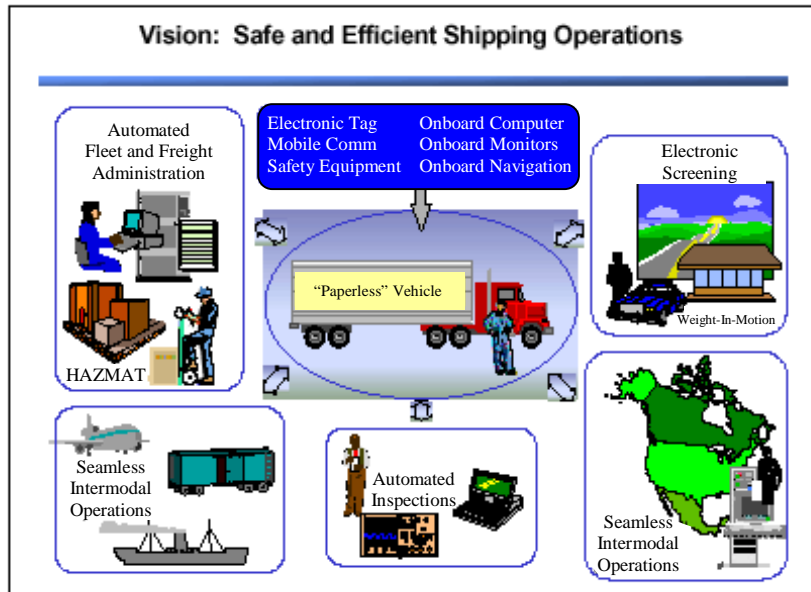
Devices in the vehicle may be operated by the driver or may automatically call for assistance in the event of an incident.



Weather Information Systems can warn rural drivers of bad storms and dangerous roadways. These systems also help authorities clear roadways more efficiently and close fewer roads.



Traveler information systems and transit services are key aspects of rural ITS. Many different transit modes, including light-rail transit and environmentally-friendly buses and vans are being explored in an effort to minimize impacts on environmentally sensitive areas and provide traffic relief in tourist-congested areas.



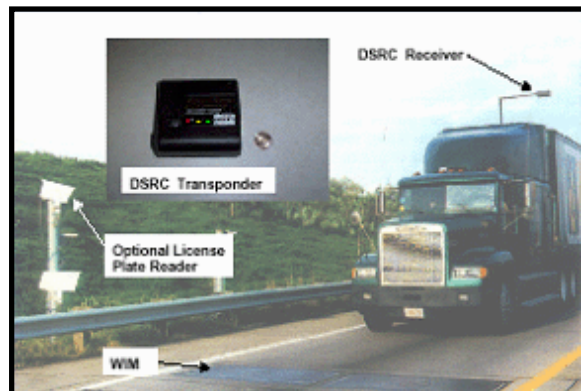
### Commercial Vehicle Operations (CVO)

The scope of CVO includes the operations associated with moving goods and passengers over the highway networks and the activities necessary to regulate those operations. ITS/CVO user services include electronic clearance, automated roadside safety inspection, onboard safety monitoring, automated administrative processes,

hazardous materials incident response, and freight mobility. These systems increase productivity for commercial fleet operators by eliminating delays and enhancing the safety of drivers and their cargos.

Although DOD may not use these systems directly, DOD could benefit greatly by hiring carriers who do use them. DOD can rely on such carriers to meet Just-In-Time schedules and to engage in cost-effective electronic commerce. These carriers have reduced shipping errors, improved flexibility in providing specialized service, and improved safety. Electronic vehicle screening systems provide pre-clearance for commercial vehicles for safety inspections and port-of-entry processing, saving time by eliminating vehicle stops. Weigh-in-motion systems eliminate the requirement for vehicle stops for weight checks.

Related to improved CVO operations are the Commercial Vehicle Information Systems and Networks (CVISN). CVISN puts emphasis on safety assurance, credentials administration, and electronic screening. The FHWA expects that CVISN will be deployed in a majority of the states by September 2003.



## ***Intelligent Vehicles***

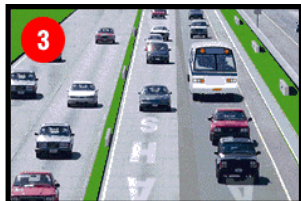
The Intelligent Vehicle Initiative goal is to accelerate the development and availability of advanced safety and information systems for all types of vehicles. Current applied research areas for intelligent vehicles are crash avoidance, in-vehicle safety, and automated highway systems. Research in human factors, advanced driver warning and vehicle control systems is also a major part of the Intelligent Vehicle Initiative.



**Vehicle System check point:** A vehicle transponder relays a signal to road sensors located in the validation lane, furnishing them with the same status of all onboard computer systems. If all systems are functioning correctly, control of the vehicle is assumed by the system.



**In vehicle navigational system:** Notes driver's destination point.

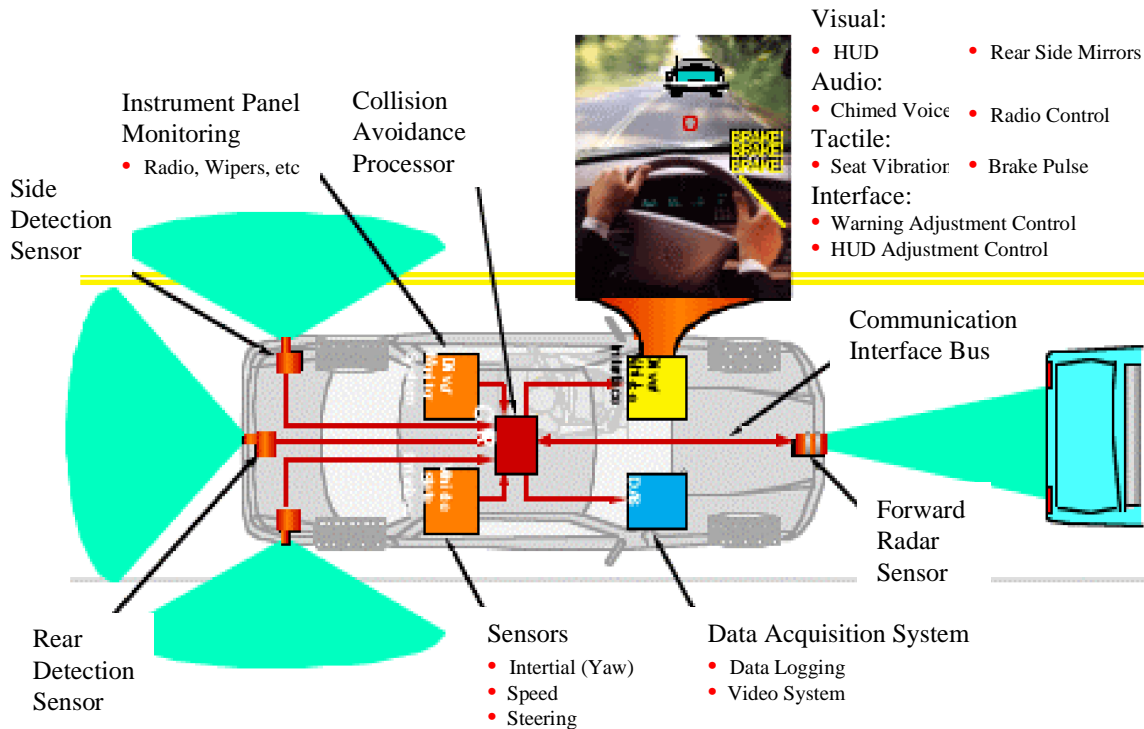


**Automated highway system:** Moves the vehicle into a protected lane, maintains safe control of the vehicles speed and steering until the driver's destination is reached. Control is then returned to the driver.



**At destination:** Upon approaching destination, a signal is emitted advising driver to resume manual control. Transponder in car sends signals to other cars which creates a space so it can exit.

Collision avoidance systems use on-board sensors to warn drivers of impending collisions or when a vehicle begins to stray from the lane of travel. The USDOT estimates that such systems could reduce all crashes by 17 percent. By the year 2010, 25-percent of commercial vehicles and 10-percent of passenger vehicles will have these systems installed.

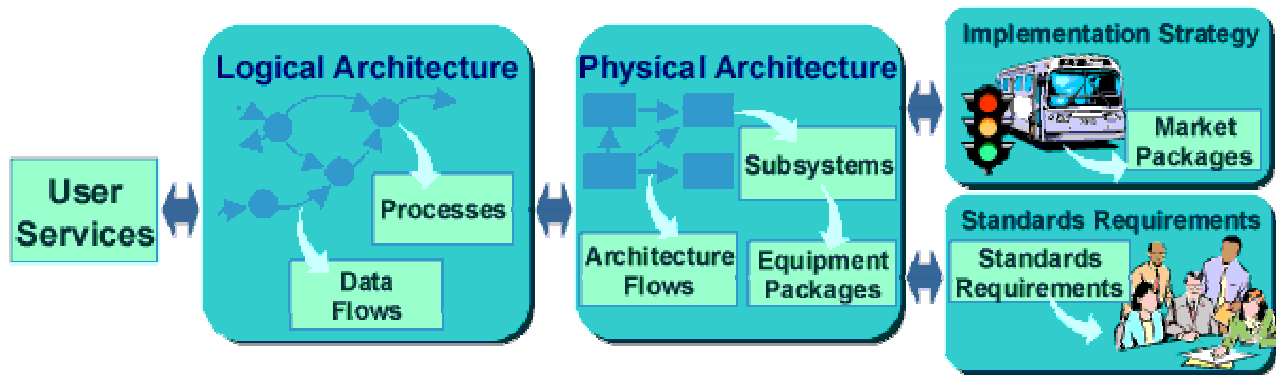


### *National ITS Architecture*

There are many different "stakeholders" in the ITS process, including DOD, USDOT, States, municipalities, research organizations, and corporations. To ensure compatibility and interoperability of systems, products, and services, the USDOT developed a National ITS architecture.

The National ITS Architecture provides a common structure for the design of ITS. It defines the basic functions that ITS must perform, the physical subsystems where these functions reside, and the data and communication flows between physical subsystems. In addition, it specifies the requirements for the standards needed to support national and regional interoperability. USDOT promotes conformance to this standard, via rulemaking or otherwise, where it has determined that the standard will significantly enhance system lifecycle economics and/or national ITS interoperability.

The USDOT published the final architecture rule in the Federal Register on 8 January 2001. The rule requires most States and municipalities to have an ITS architecture in four years where Federal resources are used to develop the ITS system.



## **DoD SURFACE DEPLOYMENT ISSUES**

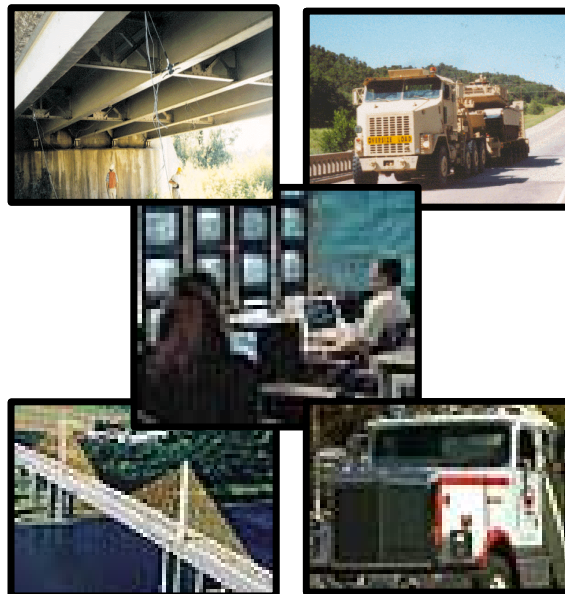
The deployment community has a multitude of concerns during movements. There are four essential concerns during a highway movement that relate to specific ITS services: assured highway access, oversize/overweight issues, intransit visibility, and safety. Table 1 summarizes these deployment concerns and associated ITS technologies.

<b>Deployment Concern</b>	<b>ITS Technology</b>	<b>Purpose</b>
Assured highway access	Traveler information systems	Provide basic mapping functions and advanced warning of construction, incidents, and traffic delays. Offer alternative routing options.
	Weather advisory systems	Provide current weather information and severe weather information such as wind, snow, flood, and hail warnings, lighting strikes, etc.
	Emergency response systems	Provide quicker response in case of on-road emergencies, potentially saving lives and clearing congestion quickly.
Oversize/Overweight	Electronic vehicle screening systems	Provide pre-clearance for commercial vehicles for safety inspections and port-of-entry processing; saves time by eliminating vehicle stops.
	Weigh-in-motion systems	Eliminate requirement for vehicle stops for weight checks.
Intransit Visibility	Automated vehicle identification (AVI), location (AVL) and load inventory systems	Using on-board transponder technology with remote receivers to automatically identify and locate vehicles.
Safety	Collision avoidance systems	Using on-board sensors to warn drivers of impending collisions and erratic lane changes.

***Table 1. Summary of Deployment Concerns and Related ITS Technologies***

## Assured Highway Access

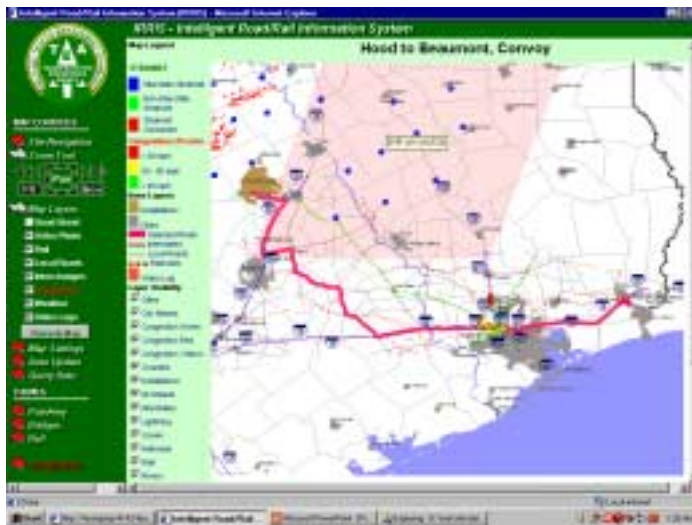
The Office of the Special Assistant for Transportation Engineering, Military Traffic Management Command Transportation Engineering Agency (MTMCTEA), on behalf of the United States Transportation Command (USTRANSCOM), administers the Highways for National Defense (HND) Program for DOD. The HND Program has as its primary goal, assuring the availability of and access to strategic highways and their connectors. Through the HND Program, MTMCTEA coordinates with numerous Federal, State, and local agencies, as well as the military services and the private sector to accomplish this objective.



*Highways for National Defense*

## IRRIS

Recently, a new effort by MTMCTEA to extend the assured highway access mission to the "real time" deployment level has brought DOD into the realm of ITS for infrastructure analysis. This effort, called the Intelligent Road/Rail Information System, or IRRIS, is an Internet-based geographic information technology that is capable of performing spatial analysis. IRRIS is a "clearinghouse" of traveler information drawn from various State departments of transportation and other ITS information developed by MTMCTEA and the commercial community. IRRIS is used to accomplish the HND mission. It could also help deploying units and transportation officers manage highway and rail deployment from home station to any location in CONUS. IRRIS provides current information about road and track conditions on the primary deployment route and possible alternative routings.



As IRRIS continues to mature, all the major and secondary CONUS deployment routes, power projection platforms, and strategic seaports will be embedded using Geographical Information System (GIS) technology. Real-time traffic and weather information for any point along the deployment routes will be pulled into IRRIS from the various State DOT and commercial data feeds in GIS format. In its ultimate configuration, users can access IRRIS via mobile devices

and can customize the types of warning and routing information they desire. The advantage of IRRIS for the military is that it is tailored to access the most current infrastructure and real-time ITS data requiring no special training or special proprietary devices.

IRRIS is a significant first step in addressing DOD deployment concerns from an ITS standpoint.



### Oversize/Overweight

Occasionally, deploying vehicles exceed size and weight limitations established by State transportation authorities. Normal vehicle size and weight limitations are as follows:

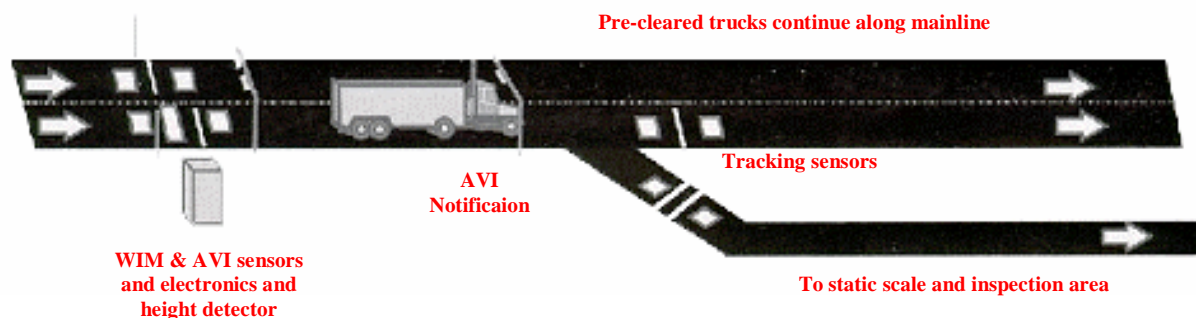
Oversize Limits		
<b>Length</b>	Single Vehicle	40 feet
	Semi trailer	48 feet
	Total combination length	55 feet
<b>Width</b>	All types	8 feet
<b>Height</b>	All types	13.5 feet

Overweight Limits	
<b>Gross Vehicle Weight</b>	80,000 pounds
<b>Single Axle Load</b>	20,000 pounds
<b>Tandem Axle Load</b>	34,000 pounds



State Department of Transportation authorities require special permits if vehicles exceed these criteria. These permits are in addition to the convoy clearance deploying units must also obtain before a highway movement. Although military convoys are not generally required to stop at inspection stations, some States require oversize or overweight military vehicles operating on public highways to stop at mandatory truck weigh stations.

ITS efforts designed to electronically and remotely screen commercial trucks can also benefit DOD deployment. Total over-the-road deployment times can be reduced if military, as well as commercial, vehicles can be pre-cleared and screened on the move, rather than having to pull into an inspection station.



Weigh-in-motion (WIM) technology, adopted for highway weigh stations, is useful for deploying military units to accurately and quickly obtain weight information for unit movement databases, provided the technology is accurate enough for these databases.

## Intransit Visibility

One of DOD's major goals is to develop and field a networked computer tracking system providing what is called "Total Asset Visibility" (TAV) over specific equipment. Such a system would be able to locate a specific part, for example, whether it was sitting on a shelf in a warehouse in Philadelphia, or on its way by air to a maintenance unit in Saudi Arabia.

From a deployment perspective, USTRANSCOM is developing a transportation-based subsystem of TAV called the Global Transportation Network (GTN). GTN provides visibility of military assets during their transit of the Defense Transportation System (DTS). This "intransit visibility" initiative, currently in the final state of full operational capability, appears to be related to the ITS technologies designed to provide automated vehicle identification (AVI) and location (AVL) information.



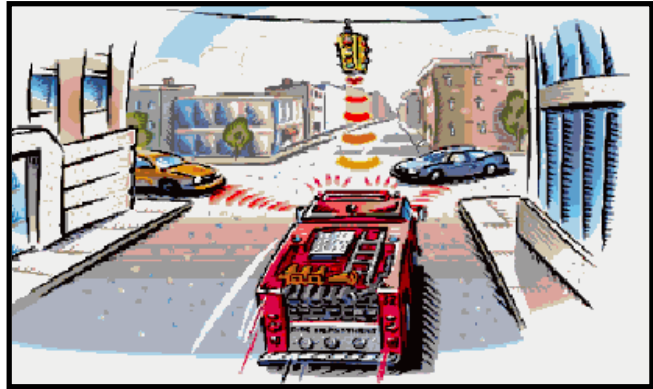
However, DOD is developing GTN independently of any State ITS initiatives. In fact, at its current stage of development, GTN would not have visibility over a convoy of self-deploying vehicles moving from an installation to a port of embarkation, although GTN developers are hoping to capture such "self-deployers" in the future. An example might be a fighter squadron self-deploying to the Middle East.

It is not within the scope of this report to investigate the feasibility of linking GTN to self-deploying vehicles.

## Safety

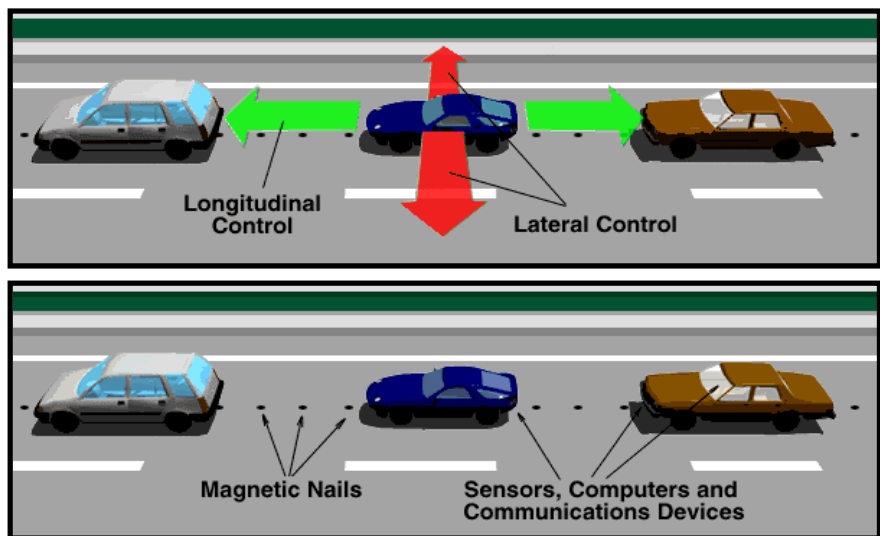
Drivers of military vehicles receive extensive training covering the vehicle operation and maintenance as well as safety considerations. Yet, military drivers are still susceptible to distractions, fatigue, and other potential causes of collisions.

Collision avoidance systems are designed to warn a driver of a potentially dangerous situation in enough time for the driver to respond by avoiding an accident. These systems employ sensors that detect the proximity of other vehicles to the front, rear, and sides of the driver's vehicle. Other safety systems can detect driver fatigue or drowsiness.



These technologies, which come under the heading of Intelligent Vehicles, are primarily passive. Active systems are those that take control of the vehicle during an emergency situation such as the impending loss of control by entering a curve at too high a rate of speed.

Manufacturers of many commercial and private owned vehicles now offer Intelligent Vehicle technologies such as collision avoidance systems as standard or optional equipment. DOD has determined that such technology is worth the investment and is partnering with USDOT to develop it for military use.



***Cars driving on automated highways will be guided under lateral (steering) and longitudinal (speed and spacing) control.***

## **ASSESSMENT OF ITS VALUE TO DOD**

In this section, we assess the value of ITS technologies to DOD deployment. An example of intelligent infrastructure application would be the use of IRRIS by a deploying unit to plan convoy movements, avoid congested areas, severe weather, and/or incidents. An example of intelligent vehicle application might involve installation of collision avoidance systems on convoy vehicles.

### **Intelligent Infrastructure**

As a primary user of the strategic highway infrastructure, DOD benefits indirectly from ITS research and development efforts. Advanced traffic management systems combined with traveler advisory systems have been shown to ease congestion through densely populated urban areas, consequently increasing the average traffic flow velocity. Deploying units are certainly beneficiaries of more optimized highway transportation system.

The IRRIS initiative, however, takes DOD from what would be a purely passive role regarding traveler information, to a more active one. By focusing on specific deployment routes, IRRIS is able to filter volumes of data from a variety of sources down to the essential real-time route information the deploying unit requires.

Advances in automated location technology have direct application to the problem of gaining visibility of DOD cargo during movement. The ability to quickly and accurately locate an asset in real time contributes to more efficient and flexible operational planning and execution. Many States and municipalities are deploying GPS transponders on their bus and emergency vehicle fleets, making them more efficient and responsive. MTMC TEA has been working with U. S. Combined Army Support Command (USCASC) to demonstrate the capability of IRRIS to receive the GPS signal from the Movement Tracking System (MTS) and plot the signal to a web-based map. MTS is a satellite-based tracking/communication system consisting of a mobile unit mounted in the vehicle and a base unit controlled/monitored by movement control and mode operators. The MTS includes a global positioning system capability, a capability to send messages between base and mobile units, and a capability to locate/track a vehicle position on a map background using personal computer-based software.

Further, the National Automotive Center (NAC) of the US Army Tank Automotive Command (TACOM) is developing a "Smart Truck" equipped with GPS. To our knowledge, GTN is not connected with the GPS transponders of either of the above systems. DOD should continue to follow the maturation of this transportation technology to see if it can be integrated with deployment visibility efforts.

Technologies that are able to quickly and accurately obtain dimensional and weight measurements of vehicles are beneficial to DOD. Accurate unit movement data is critical during deployments when preparing stow plans for both ships and aircraft. Several years ago, DOD funded an effort to develop a prototype device called the Transportation Automated Measurement System (TrAMS). After a successful prototype test, DOD explored efforts to make the device more portable and less costly. Further progress on TrAMS has been slow.

However, remote sensing and measurement technology is continuing to improve, being driven by ITS efforts worldwide. DOD may eventually be able to develop newer and more portable automated measurement systems that will accelerate the deployment process.

Appendix B is a relevant listing of current State ITS efforts. MTMCTEA monitors changes to State DOT ITS sites for potential use in IRRIS and for DOD consideration.

### **Intelligent Vehicles**

Through the NAC, the US Army is investigating Collision Avoidance Systems (CAS) and lane detection systems. According to NAC figures, 42-percent of peacetime fatalities occur during vehicle accidents in convoy situations. Disposal costs of destroyed vehicles and the cost of repairs can total up to 25 million dollars annually. By incorporating commercially available CAS technology, the Army hopes to reduce these costs and prevent injuries and fatalities. NAC is also investigating linking CAS to Adaptive Cruise Control (ACC) systems, which can automate the task of maintaining headway with the vehicle in front.

The NAC, in partnership with the University of Michigan, is investigating lane detection and lane keeping technology. These systems warn drivers when a vehicle is about to stray from its lane. Radar-based systems can operate in all types of weather and visibility conditions.

## **Recommended DOD Position on ITS**

Based on this quick review of ongoing ITS efforts, we have developed the recommendations below. DOD should continue to champion research and development in all areas of ITS. The benefits of advanced computing and communication technologies to the nation's transportation infrastructure can only enhance DOD's ability to deploy. Specifically, DOD should:

- Continue development of a fully functional IRRIS capability to aid deployment planners, port operators, and hazardous material coordinators.
- Monitor Federal and State ITS technology development and deployment.
- Participate in the national dialogue on ITS through associations such as ITS America, American Association of State Highway and Transportation Officials, Institute of Transportation Engineers, Transportation Research Board, and other national ITS forums.
- Use MTMCTEA as the intelligent infrastructure focal point for ITS. MTMCTEA will coordinate DOD intelligent infrastructure efforts and provide liaison with USDOT and other agencies/associations on ITS.
- Continue to actively pursue the development and deployment of collision avoidance system technology in DOD vehicles through organizations like the National Automotive Center along with public/private consortia.
- Examine the integration of ITS initiatives in Automated Vehicle Location and Identification systems with existing DOD in-transit visibility efforts.
- Continue to follow the maturation of weigh-in-motion and remote measurement technologies that DOD can use to develop unit movement data.
- Consider the need to hire motor freight carriers that utilize the latest in ITS/Commercial Vehicle Operations (CVO). ITS/CVO user services include electronic clearance, automated roadside safety inspection, on-board safety monitoring, administrative processing, hazardous materials incident response, and freight mobility.

## **Appendix A**

### **LIST OF ACRONYMS**

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**Military Traffic Management Command  
Transportation Engineering Agency**

<b>AVC</b>	Automated Vehicle Classification
<b>AVI</b>	Automated Vehicle Identification
<b>AVL</b>	Automated Vehicle Location
<b>CAS</b>	Collision Avoidance System
<b>CCTV</b>	Closed Circuit Television
<b>CVISN</b>	Commercial Vehicle Information Systems and Networks
<b>CVO</b>	Commercial Vehicle Operations
<b>DOD</b>	Department of Defense
<b>FHWA</b>	Federal Highway Administration
<b>GIS</b>	Geographical Information System
<b>GPS</b>	Global Positioning System
<b>GTN</b>	Global Transportation Network
<b>HAR</b>	Highway Advisory Radio
<b>HELP</b>	Heavy Vehicle Electronic License Plate
<b>IOC</b>	Initial Operating Capability
<b>IRRIS</b>	Intelligent Road/Rail Information System
<b>ITS</b>	Intelligent Transportation System
<b>IVI</b>	Intelligent Vehicle Initiative
<b>MTMCTEA</b>	Military Traffic Management Command Transportation Engineering Agency
<b>NAC</b>	National Automotive Center
<b>TARDEC</b>	Tank Automotive Research Development and Engineering Center
<b>TAV</b>	Total Asset Visibility
<b>TrAMS</b>	Transportation Automated Measuring System
<b>USDOT</b>	United States Department of Transportation
<b>USTRANSCOM</b>	United States Transportation Command
<b>VMS (CMS)</b>	Variable Message Signs (Changeable Message Signs)
<b>WIM</b>	Weigh-in-Motion

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## **Appendix B**

### **STATE INTELLIGENT TRANSPORTATION SYSTEMS**

Based on an analysis of recent USDOT information, all 50 States have some form of ITS programs in progress. There are 50 traffic operations centers, 300 plus travel information telephone numbers, 75 percent of toll roads with electronic toll collection, and 25 percent of large cities have transit with automated vehicle location. By 2005, the USDOT estimates that 75 of the most populated cities will have an integrated metropolitan ITS deployment. The most significant ITS investments are in the area of advanced traffic management (surveillance and control) and traveler information systems. This is understandable, as these two technologies relate directly to alleviating the growing traffic congestion problems.

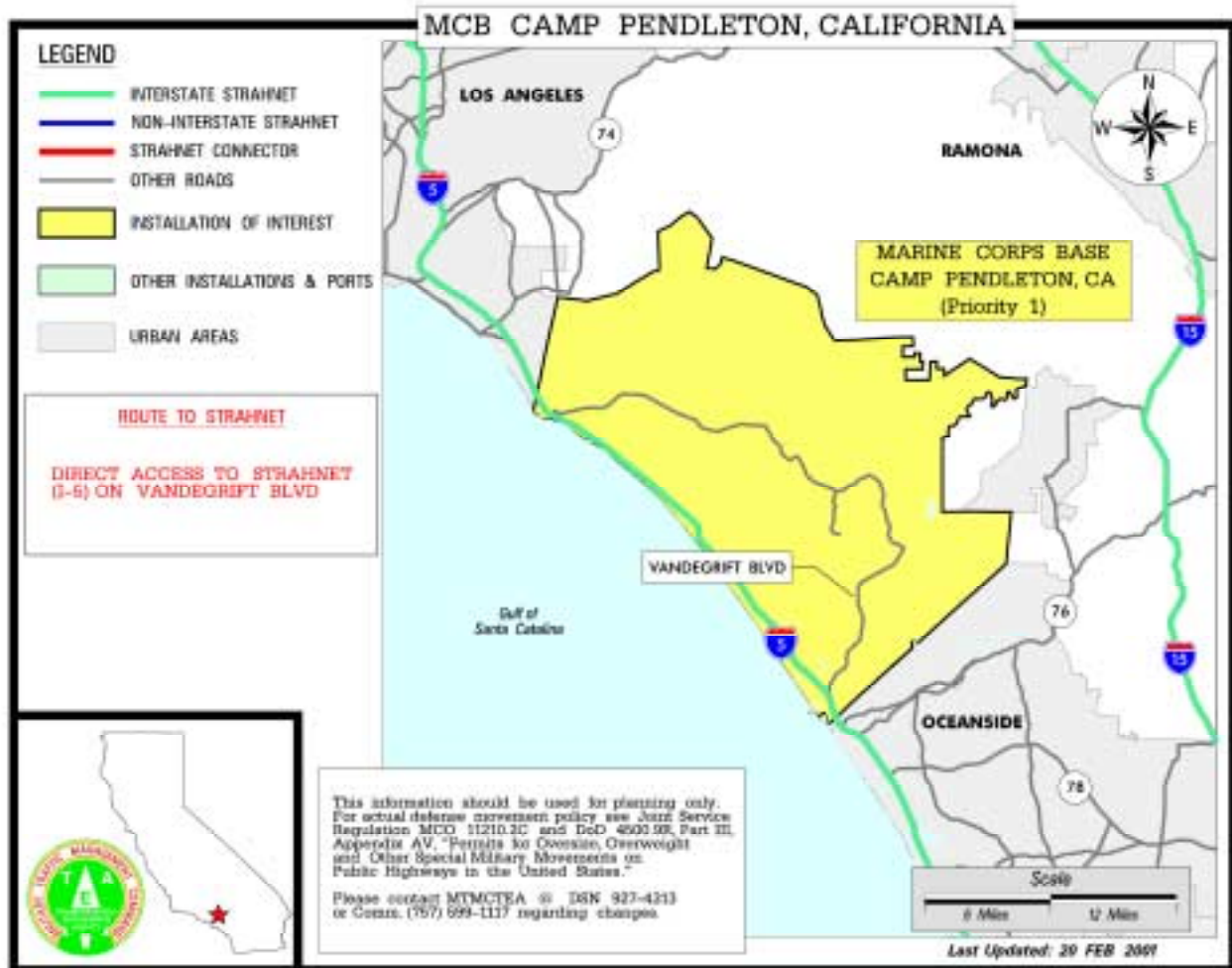
This section summarizes ITS efforts to date in those states with either DOD-important Power Projection Platform (PPP) installations or strategic ports. The ITS technologies addressed are those relating to the four DOD deployment issues discussed in the previous section.

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## CALIFORNIA

**PPP:** Camp Pendleton

**Strategic Ports:** NWS Concord, Oakland, Port Hueneme, Long Beach, and San Diego



In FY 1999, the State of California earmarked nearly 7 million dollars for ITS. From FY 1992 through FY 1999, California has designated a total of \$26,375,358 for ITS projects. The State targeted one third of these expenditures for the Los Angeles and Anaheim areas.

### Assured Highway Access

Much of the ITS infrastructure deployed in California consists of automated traffic surveillance and control. The USDOT reports that ITS measures in the Los Angeles county area have reduced travel times by 12 percent, intersection delay by 32 percent, and intersection stops by 30 percent when compared to traditional traffic signal optimization practices.

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TransCal is a traveler information system developed for northern California and parts of Nevada. Access to the travel advisory portion is by telephone. There is also an emergency notification system test project using a satellite to locate vehicles in mountainous terrain.

Operation Respond provides an electronic link with 911 operators to facilitate response to hazardous material incidents.

The California Department of Transportation has set up a traveler advisory Internet site at <http://www.dot.ca.gov/roadsandtraffic.html>. Travelers can access real-time video of traffic conditions in selected cities at this link: <http://video.dot.ca.gov>. A speed map of the San Diego area freeways is located at <http://www.dot.ca.gov/dist11/d11tmc/sdmap/mapmain.html>. This site has an interactive map showing areas of traffic congestion in yellow and red based on average traffic velocity.

**Oversize/Overweight**

California is one of eight States participating in the Commercial Vehicle Information Systems and Networks (CVISN) pilot project. CVISN links automated roadside inspection, commercial vehicle administrative processes and electronic clearance services. California has equipped 23 of its inspection facilities with weigh-in-motion sensors and transponders to electronically weigh and identify commercial vehicles and check their safety and State-required credentials.

**Intransit Visibility**

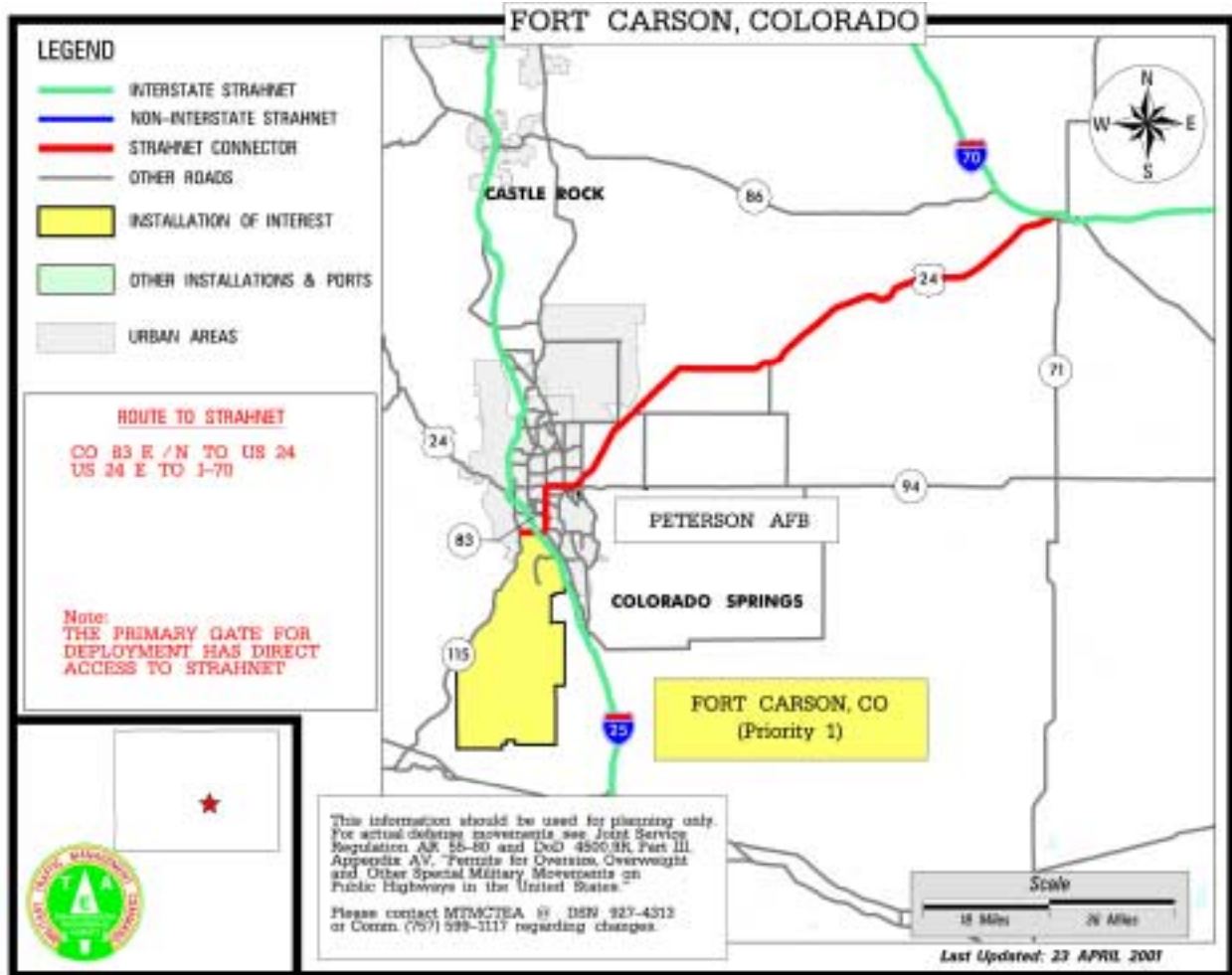
The Heavy Vehicle Electronic License Plate (HELP) is a public/private partnership. Through HELP, new technologies such as automatic vehicle identification (AVI) and automatic vehicle classification (AVC) are being tested. The TransCal Emergency Notification System mentioned above, is a test bed for automatic vehicle location (AVL) using satellites. AVL technology is primarily being deployed in transit systems, to locate busses and trains. The Santa Clara county Smart Paratransit program will use GPS technology for AVL operation of a paratransit system in conjunction with bus, light rail, and train operation.

**Safety**

There are no reported State-sponsored programs for in-vehicle collision avoidance.

## COLORADO

**PPP: Fort Carson**  
**Strategic Ports: None**



In FY 2000, the State of Colorado earmarked 5 million dollars for ITS. Since FY1998, Colorado has designated a total of 14 million dollars for ITS projects. Almost two thirds of these expenditures have been targeted for the Colorado I-25 Truck Safety Improvement program, which integrates ITS components along the I-25 corridor between Denver and Colorado Springs, and automates ports of entry along the I-25 NAFTA trade corridor.

### Assured Highway Access

The Colorado Transportation Management System (CTMS) is a comprehensive and integrated system of ITS deployments including traveler information systems, traffic management systems, public transportation systems, and commercial vehicle operations (CVO) systems. Traffic

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Transportation Engineering Agency**

management includes ramp metering on freeways, traffic signal timing, incident detection and response, and better dissemination of real-time information to the traveling public.

The Colorado Department of Transportation (CDOT) maintains an Internet web site providing traveler information about road conditions, weather, construction and pass openings. This information is near real time and can be found at <http://www.cotrip.org/index.html>.

**Oversize/Overweight**

Colorado is one of eight States chosen to demonstrate the CIVSN system. In addition, the State has conducted a Dynamic Downhill Truck Speed Warning Operational test. The purpose of this test was to identify safe operating speeds for long downhill grades. It uses WIM technology, speed verification systems, and variable signs to recommend, in real time, the speed a truck driver should not exceed.

**Intransit Visibility**

The Denver area Regional Transportation District is sponsoring a project to install AVL systems on busses. The system will use Global Positioning System (GPS) transponders mounted on each bus to tell a central dispatch office the exact location of each vehicle.

The Colorado Mayday system will also use GPS for vehicle location and cell phone for two-way communication to provide emergency and non-emergency assistance to travelers in remote rural areas of the State.

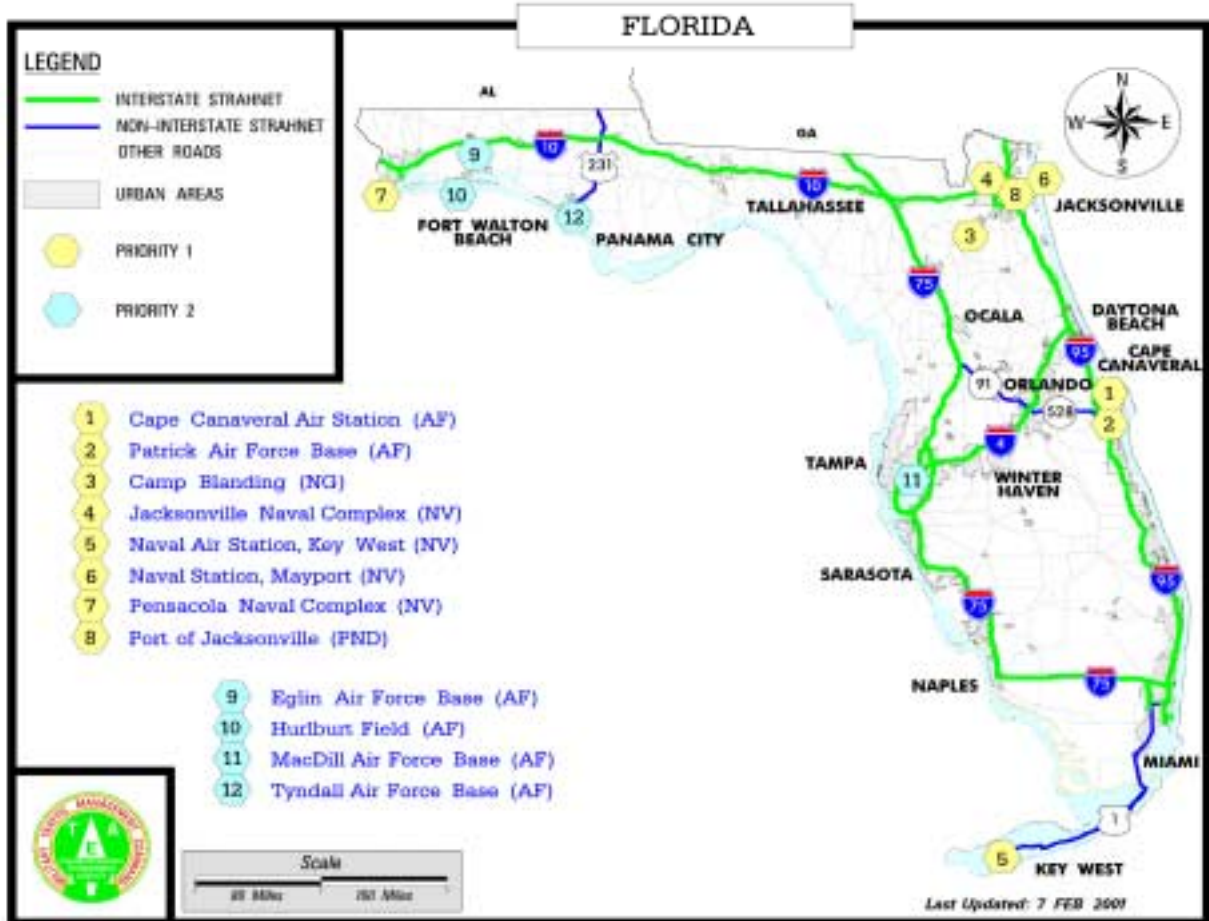
**Safety**

The State of Colorado has not funded programs relating to in-vehicle collision avoidance safety technology.

## FLORIDA

PPP: None

Strategic Ports: Jacksonville



Since FY 1992, Florida has spent a total of 16.5 million dollars on ITS projects. The bulk of this funding has been allocated to the southeastern part of the State, particularly between Miami and Fort Lauderdale (Flamingo Rd.).

### Assured Highway Access

Installation has begun in the Jacksonville Urban Area of an Advanced Traffic Management System. Closed circuit television, fiber optic cables and vehicle detection devices have been installed along six miles of I-10 near Jacksonville.

In general, Florida has focused on freeway management in major urban areas using television cameras, variable message signs and vehicle detectors. A traffic information web site with historical/typical traffic volumes is located at <http://www3.dot.state.fl.us/trafficinformation/>, however, this site does not provide real-time, web-based traffic information.

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Transportation Engineering Agency**

The TravTek project, in the Orlando area, was one of the country's first successful demonstrations of advanced traveler information supplemented with real-time traffic information.

**Oversize/Overweight**

Florida has implemented weigh-in-motion, electronic tag communications, and computerized credential checking technologies along the I-75 corridor to Ontario.

**Intransit Visibility**

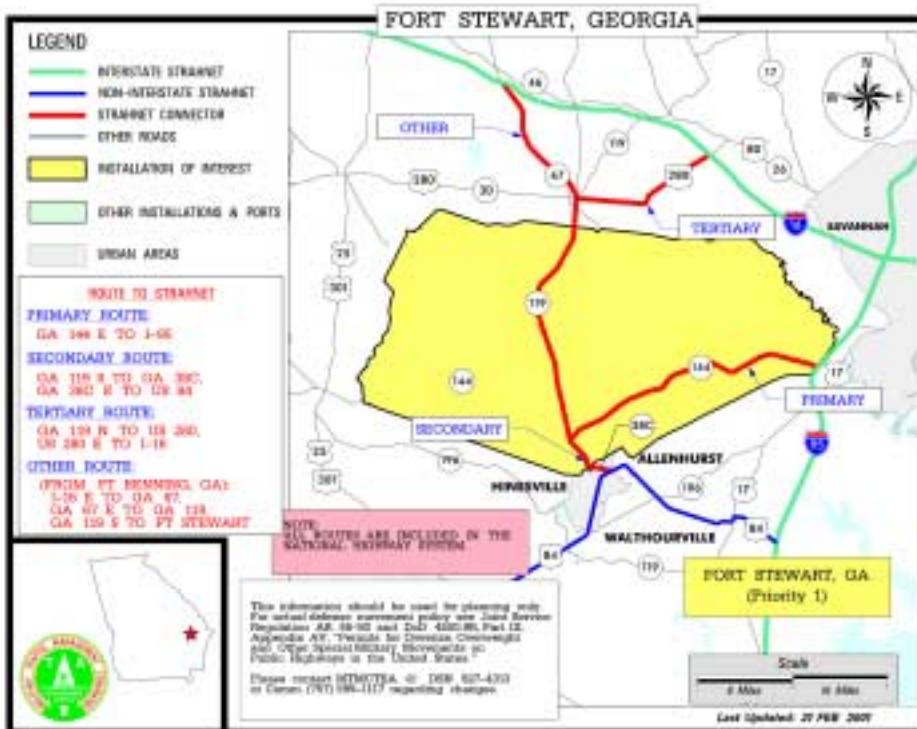
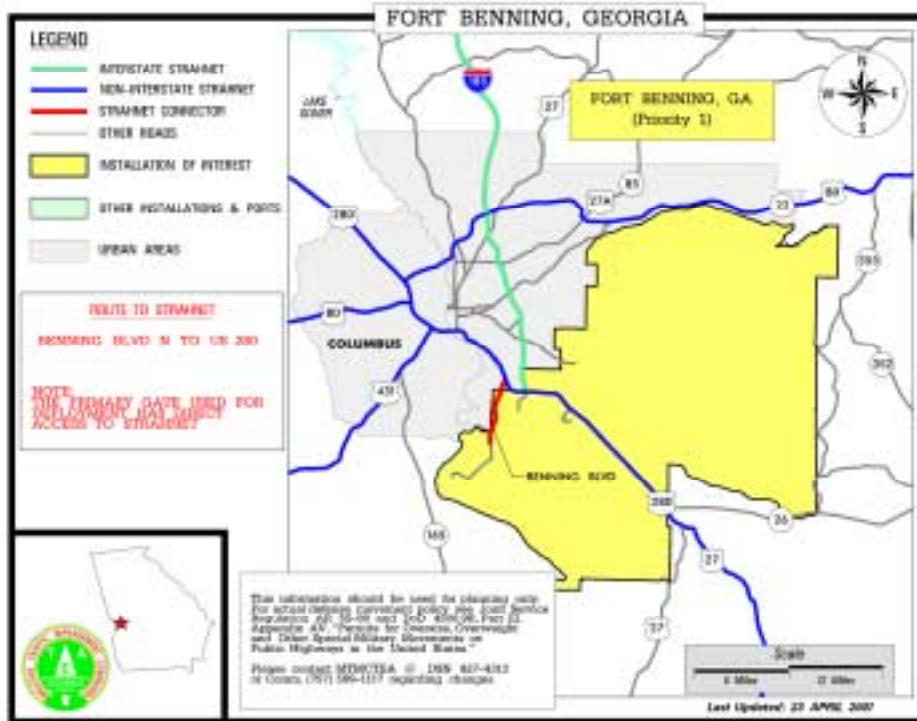
Metro-Dade Transit Agency has installed AVL systems in all county-owned vehicles. Broward county transit will also use AVL.

**Safety**

The State of Florida has not funded programs relating to in-vehicle collision avoidance safety technology.

## GEORGIA

**PPP: Fort Benning, Fort Stewart**  
**Strategic Ports: Savannah**



**Military Traffic Management Command  
Transportation Engineering Agency**

The only ITS spending data the USDOT has for the State of Georgia is about 1.6 million dollars earmarked for FY 1999. It appears that most, if not all of this money was targeted for the Georgia "Navigator," a comprehensive traveler information and advisory system.

**Assured Highway Access**

The Navigator is primarily dedicated to the greater Atlanta metropolitan area. It provides traveler information via changeable message signs connected by a fiber optic network. Navigator has a central Internet web site (<http://www.georgia-navigator.com>) with real-time traffic speed and congestion information, as well as live web cameras. There is a travel time link that computes the estimated travel time between selected points on the local freeway system given the current traffic conditions.

Georgia's incident response system is called HERO, which is short for Highway Emergency Response Operators. HERO is a system of roving patrol vehicles that respond to emergencies and other incidents based on information provided by Navigator. There is also a toll-free cellular phone number for both traffic and incident related information.

**Oversize/Overweight**

Georgia, in partnership with other States and other private and public sector partners, has implemented ITS commercial vehicle operations along the I-75 corridor. The system uses electronic clearance, weigh-in-motion, electronic tag communications with the roadside, and computerized credential checking technologies.

**Intransit Visibility**

The Metro Atlanta Rapid Transit Authority (MARTA) uses AVL technology (GPS) to locate and track vehicles in its system. The status is displayed on a GIS map. One third of the MARTA vehicle fleet is equipped with the GPS transponders.

**Safety**

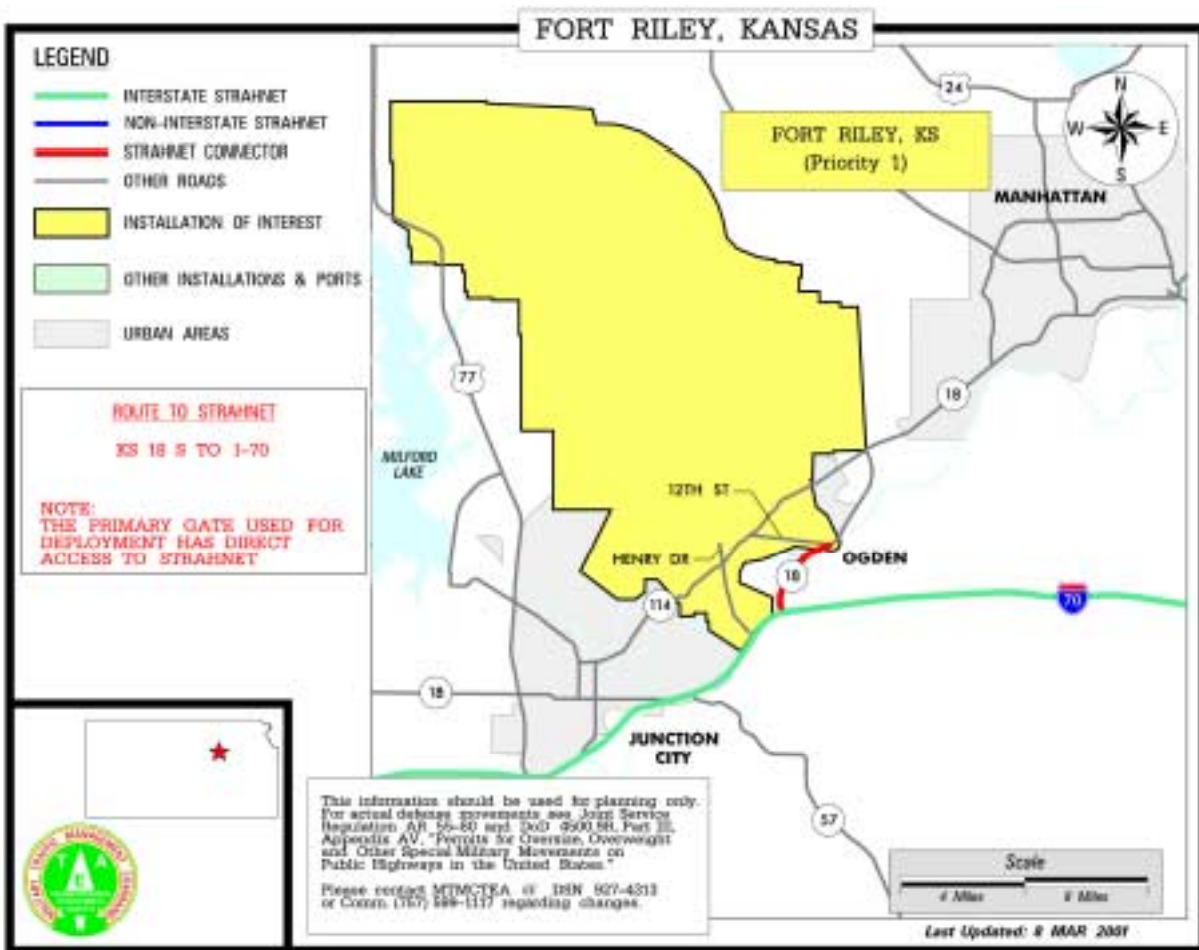
The State of Georgia has not funded programs relating to in-vehicle collision avoidance safety technology.

## KANSAS

**PPP: Fort Riley**

**Strategic Ports: None**

The USDOT data on the ITS program in Kansas does not provide any information on ITS funding in the State.



### Assured Highway Access

Kansas is designing a freeway management system called Kansas City Scout, which will use CCTV, VMS, detectors, highway advisory radio and ramp metering to reduce congestion and assist in incident response.

The State is researching the development of a statewide Mayday system. This system would combine GPS with cellular technology to automatically transmit an emergency call to a local dispatcher in the event of an emergency.

**Military Traffic Management Command  
Transportation Engineering Agency**

Road Weather Information System (RWIS) technology is in use in Kansas. Roadside kiosks are being considered as the medium for delivering this information to the traveler.

The State completed an ITS deployment study, concluding that incident management, signal control, railroad grade crossing safety, transit upgrades and freeway management are all areas that could benefit from ITS.

**Oversize/Overweight**

Kansas is participating in CVISN, which relies on WIM and transponder technologies to increase the efficiency of commercial vehicle processing.

**Intransit Visibility**

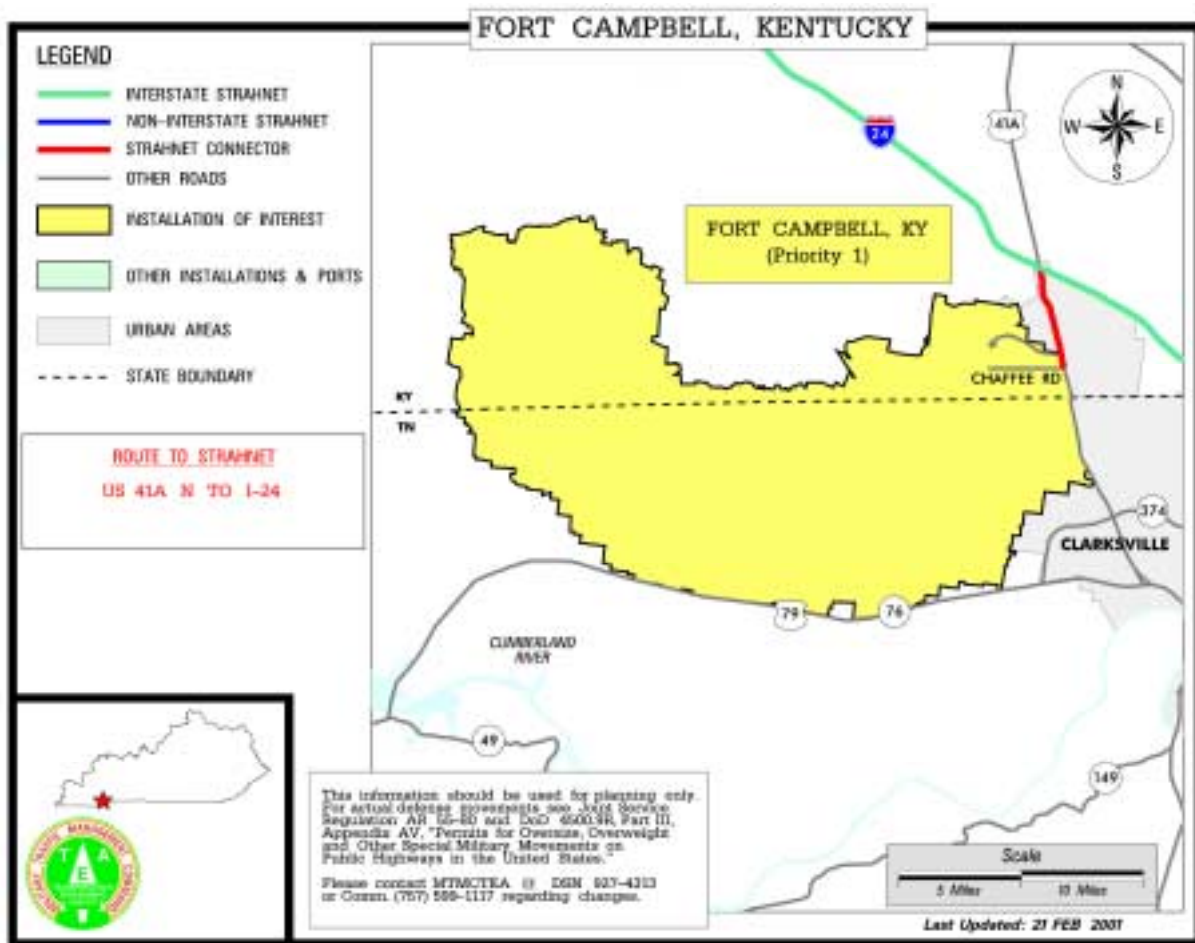
The Kansas Highway Patrol is using AVL to track the location of troopers when on patrol and in pursuit. The system uses GPS to track location and is tied into a GIS-based map at the dispatch center.

**Safety**

Kansas has an Intelligent Vehicle Initiative (IVI). The Kansas Department of Transportation participated in a public/private partnership that developed DAS 2000, a lane deviation warning device.

## KENTUCKY

**PPP: Fort Campbell**  
**Strategic Ports: None**



### Assured Highway Access

Kentucky and Ohio have partnered in organizing a regional traffic management system called Advanced Regional Traffic Interactive Management and Information System (ARTIMIS). The first phase of this program is called SmarTraveler, and is being fielded in the Northern Kentucky and Greater Cincinnati areas. SmarTraveler commenced operations in 1995, and provides 24-hour, current and route specific information to travelers, who can access this information via cell phone.

In the Lexington area, the Lexington-Fayette Urban County Government Traffic Information Network (TIN) is collecting traffic information using video surveillance, law enforcement, DOT and Public Works, utilities, transit, airport, and a weather tracking system.

**Oversize/Overweight**

Advantage I-75 is a multi-state program lead by Kentucky to allow transponder-equipped commercial vehicles to travel any segment along the entire length of I-75 at mainline speeds with minimal stopping at weigh/inspection stations.

**Intransit Visibility**

No intransit visibility initiatives reported.

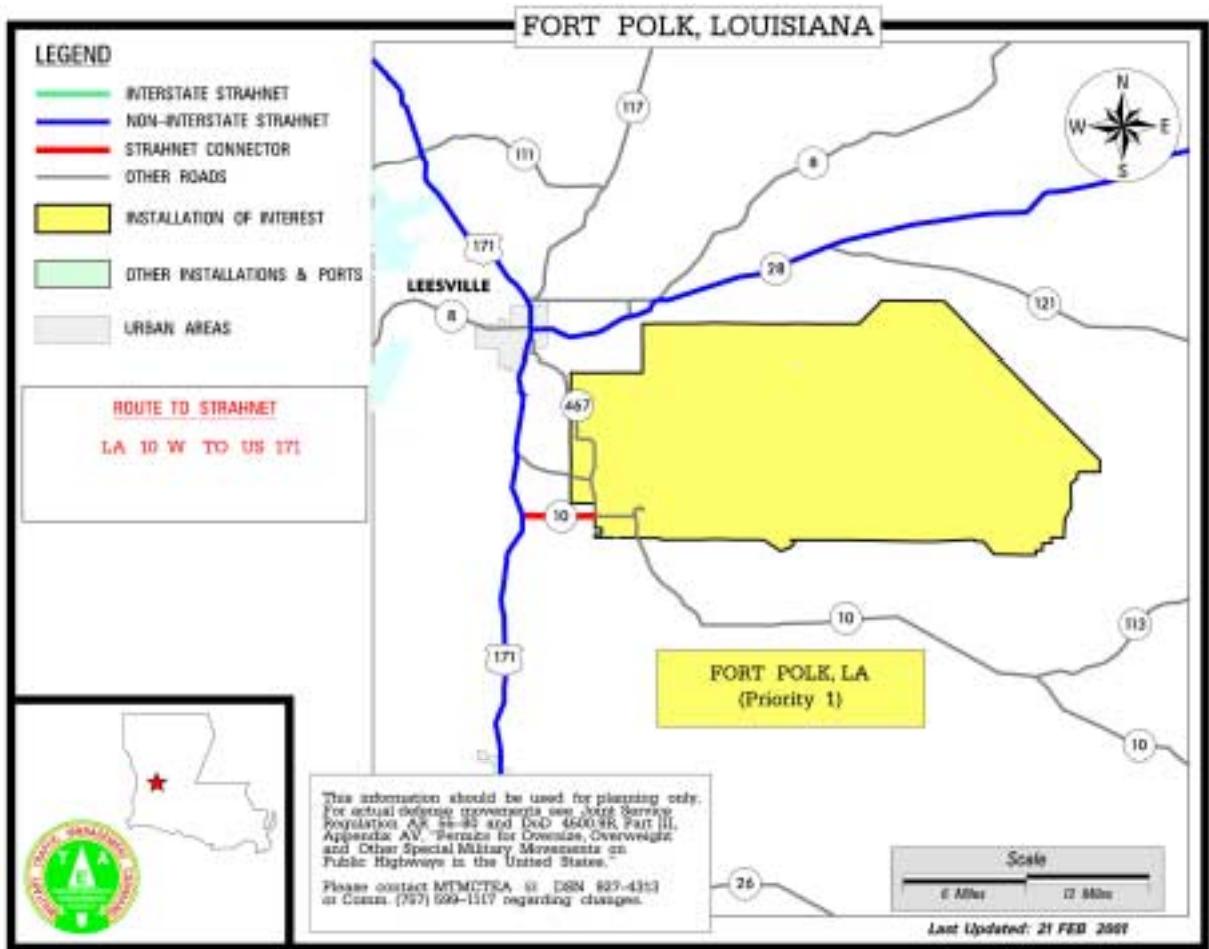
**Safety**

No intelligent vehicle initiatives reported.

## LOUISIANA

**PPP: Fort Polk**

**Strategic Ports: None**



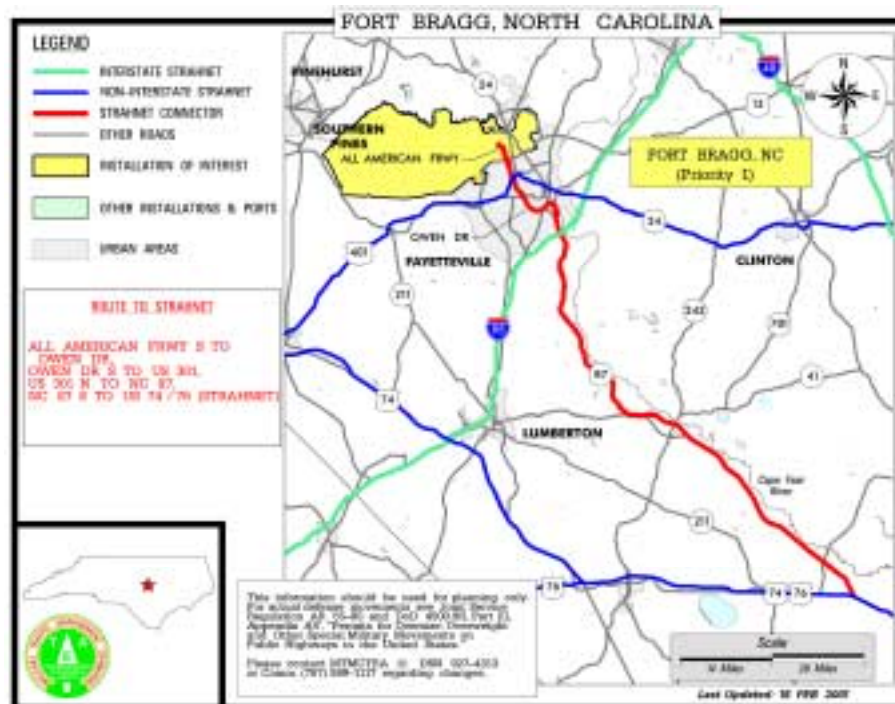
Louisiana is in the process of studying ITS deployment for the State. The only actual reported ITS deployment is an electronic toll collection system on the Crescent City Connection Bridge. The city of Baton Rouge is developing plans for the construction of a Traffic Management Center.

Louisiana is also developing a strategic business plan to define the scope of ITS/CVO deployment activities, projected costs, implementation schedules and anticipated accomplishments.

## NORTH CAROLINA

**PPP: Fort Bragg, Camp Lejeune**

**Strategic Ports: Wilmington, Moorehead City, Sunny Point**



Since 1994, North Carolina has earmarked just over 13 million dollars for ITS. Most of this funding (10.5 million dollars) came from Congressional earmarks in the 1994 and 1995 Appropriations Bills, and was designated for a program called Congestion Avoidance and Reduction of Autos and Trucks project (CARAT). The CARAT program was targeted as a long-range congestion management system for freeways and connecting arterials in the Charlotte area.

### **Assured Highway Access**

On the North Carolina Department of Transportation (NCDOT) web site, there is a link to NC SmartLink, a site that provides current traffic information and video to travelers in the State. NC SmartLink (<http://www.ncsmartlink.org>) is set up on a county-by-county basis for real-time traffic flow and incident information. This data is fed into the SmartLink system via detectors, traffic flow monitoring devices, closed-circuit television cameras and other sources.

North Carolina does not appear to have an automated incident management system.

### **Oversize/Overweight**

North Carolina has participated with other Southeastern States in studies on the use of information technology to improve trucking and trucking regulation enforcement in the Southeast.

### **Intransit Visibility**

The Winston-Salem area is testing what they call automatic paratransit vehicle location.

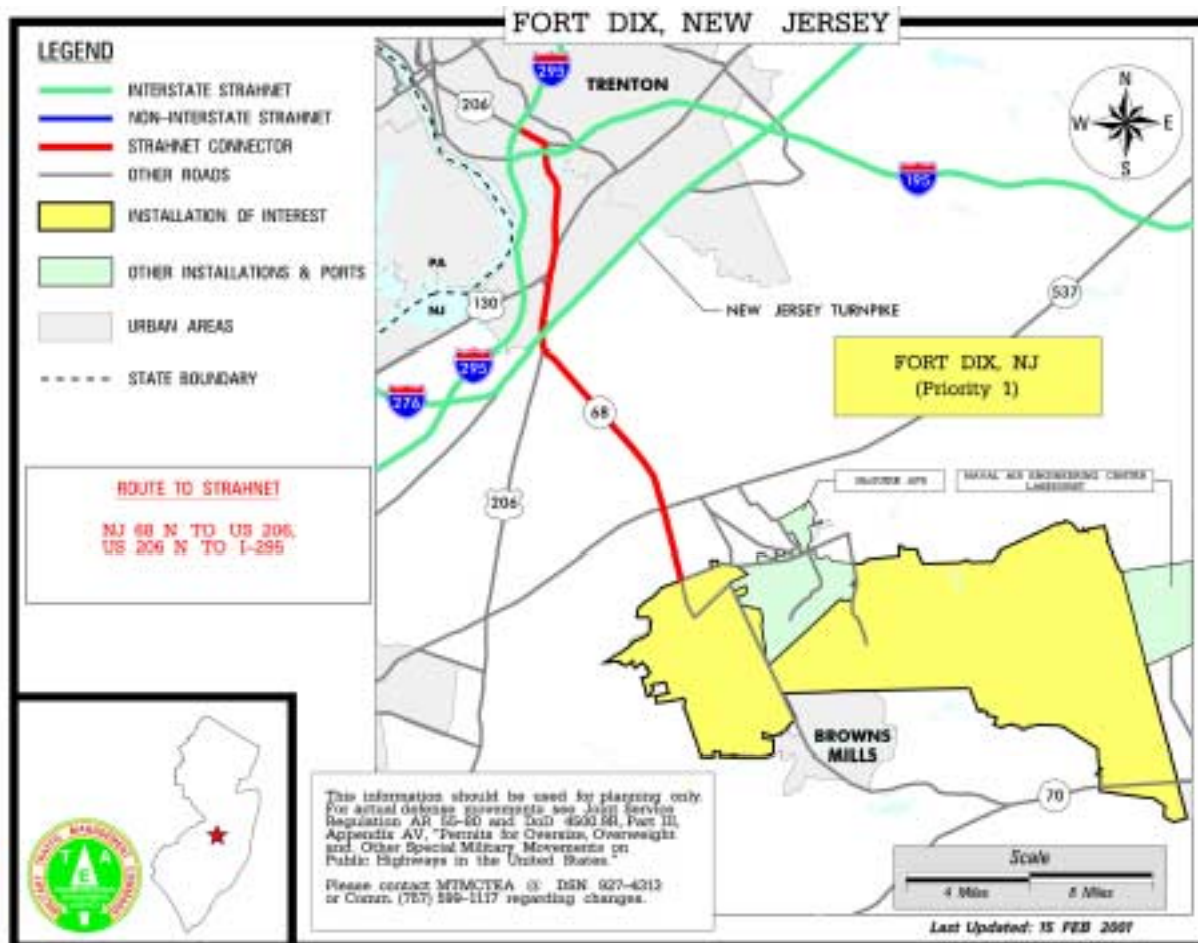
### **Safety**

No intelligent vehicle initiatives reported.

## NEW JERSEY

**PPP: Fort Dix**

**Strategic Ports: New York/New Jersey**



Since FY 1992, New Jersey has earmarked a total of 91 million dollars for ITS related projects. More than a third of this funding has been designated for Electronic Toll and Traffic Management (ETTM) initiatives on the state's toll roads. About 15 percent of the earmarked funds were designated for TRANSCOM (not to be confused with the U.S. Transportation Command), the regional consortium of 14 transportation and public safety agencies in New Jersey, New York and Connecticut. TRANSCOM stands for Transportation Operations Coordinating Committee.

### Assured Highway Access

The TRANSCOM program will provide travelers in the NY-NJ-CT metro area with real-time traffic and transit information via kiosks. The TRANSMIT system (part of TRANSCOM) will provide surveillance of roadway traffic conditions in the New York metro area. Additionally, an

internet-based system, called iTravel, will provide travelers with real-time traffic information and transit trip planning.

Metropolitan Area Guidance Information and Control (MAGIC), is a project along I-80, which employs detectors, cameras, and message signs to deliver real-time information to motorists about congested or emergency locations, and alternate route recommendations. Full completion is expected in 2001.

The NJ Turnpike Authority also uses loop detectors, cameras and variable message signs to manage operations. It also includes several weather surveillance stations.

A significant amount of money (14 percent of the total 91 million dollars earmarked for ITS since 1992) has been spent on computerization of traffic signal devices on several State routes. The 27 million dollar system on Route 1 is almost complete.

### **Oversize/Overweight**

The information provided on the New Jersey ITS program as of December 1999, did not list any active implementation of CVO initiatives. New Jersey, along with several other States in the northeast, has completed a preliminary study of issues surrounding the use of information technology to improve trucking and trucking regulation and enforcement.

### **Intransit Visibility**

The TRANSMIT system has used AVI technology as an incident detection tool on the New York State Thruway and the Garden State Parkway. AVI "tag" readers treat vehicles equipped with transponders as traffic probes.

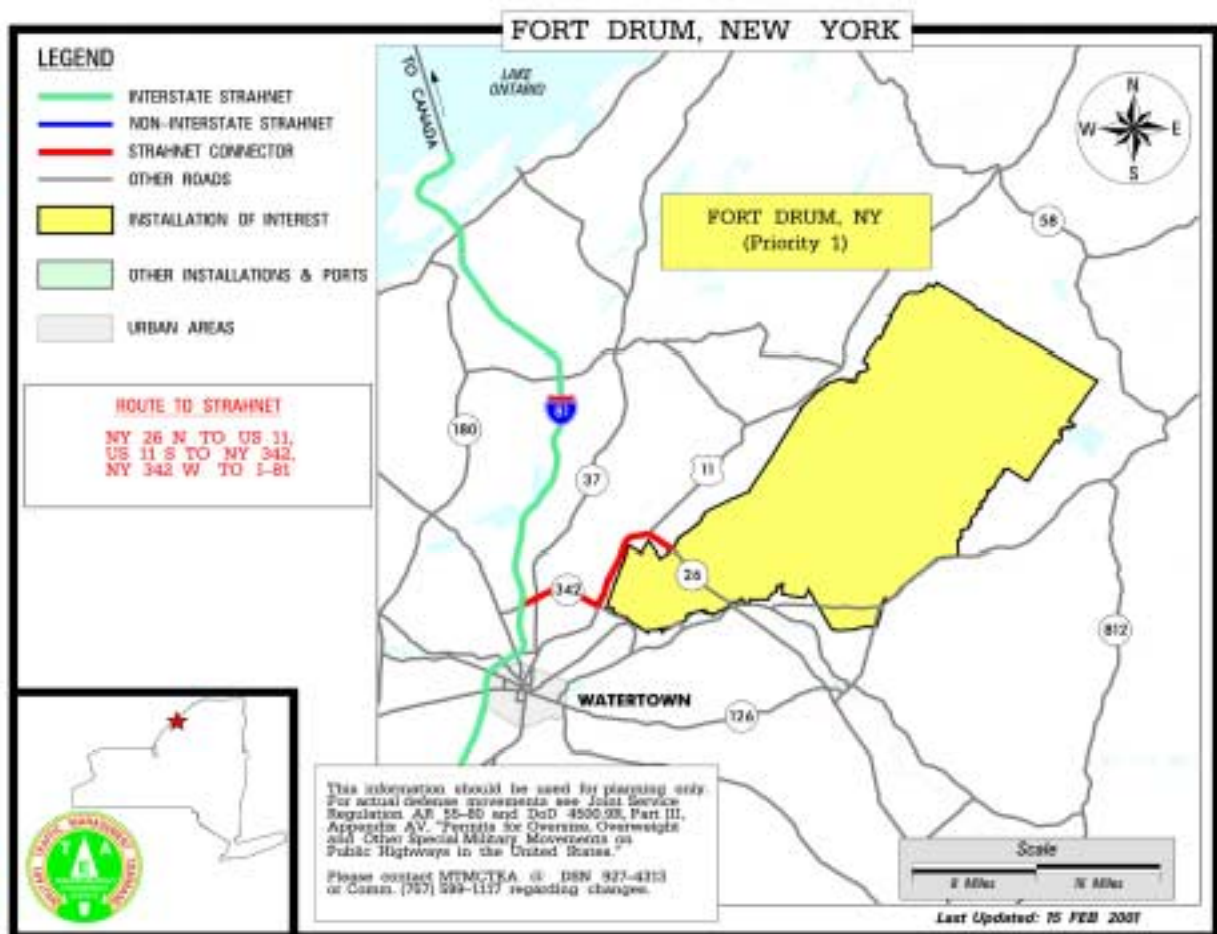
### **Safety**

No intelligent vehicle initiatives reported.

## NEW YORK

**PPP: Fort Drum**

**Strategic Ports: NY/NJ**



Since FY 1992, New York has earmarked more than 80 million dollars for ITS projects in the State. The lion's share of these funds, or over 50 million dollars, has been allocated to the two major highways in New York, the Southern State Parkway and the New York Thruway. The 80 million dollars does not include the TRANSCOM initiative, which is listed under the State of New Jersey.

### Assured Highway Access

The NY DOT's primary efforts will be in establishing Advanced Traffic Management Systems (ATMS) in major urban areas. The INFORM project, which has been in existence for 10 years, uses VMS, detectors, ramp metering, and computerized traffic signals. The Southern State parkway is being instrumented and integrated with both INFORM and the I-95 corridor.

The Bronx/Northern Manhattan ATMS will also include highway advisory radio (HAR) and CCTV, in addition to VMS, detectors and other advanced traffic controllers.

The Port Authority of New York/New Jersey is in the process of linking various traffic management systems in and around the Newark and JFK airports with the surrounding traffic management systems.

The New York DOT does not have an interactive web site providing real-time traveler information.

### **Oversize/Overweight**

New York has implemented an automated international border crossing system between Buffalo and Fort Erie, Ontario. This \$2.3 million dollar project is an integrated system that will allow non-stop international border crossings at the Peace Bridge for about 1500 passenger vehicles and 500 commercial vehicles, which have been pre-cleared for Customs and Immigration purposes. The project also integrates elements of electronic toll collection and commercial vehicle operations such as weigh in motion and safety inspection data. The system is currently operational and undergoing a two-year test period.

### **Intransit Visibility**

The Niagara Frontier Transportation Authority has procured GPS/AVL technology for 350 buses serving the cities of Buffalo and Niagara Falls. The cities of Rochester and Syracuse are also procuring AVL systems for their transit buses.

In New York City and Long Island, GPS/AVL systems will provide real-time transit information for trip preplanning and en route notification.

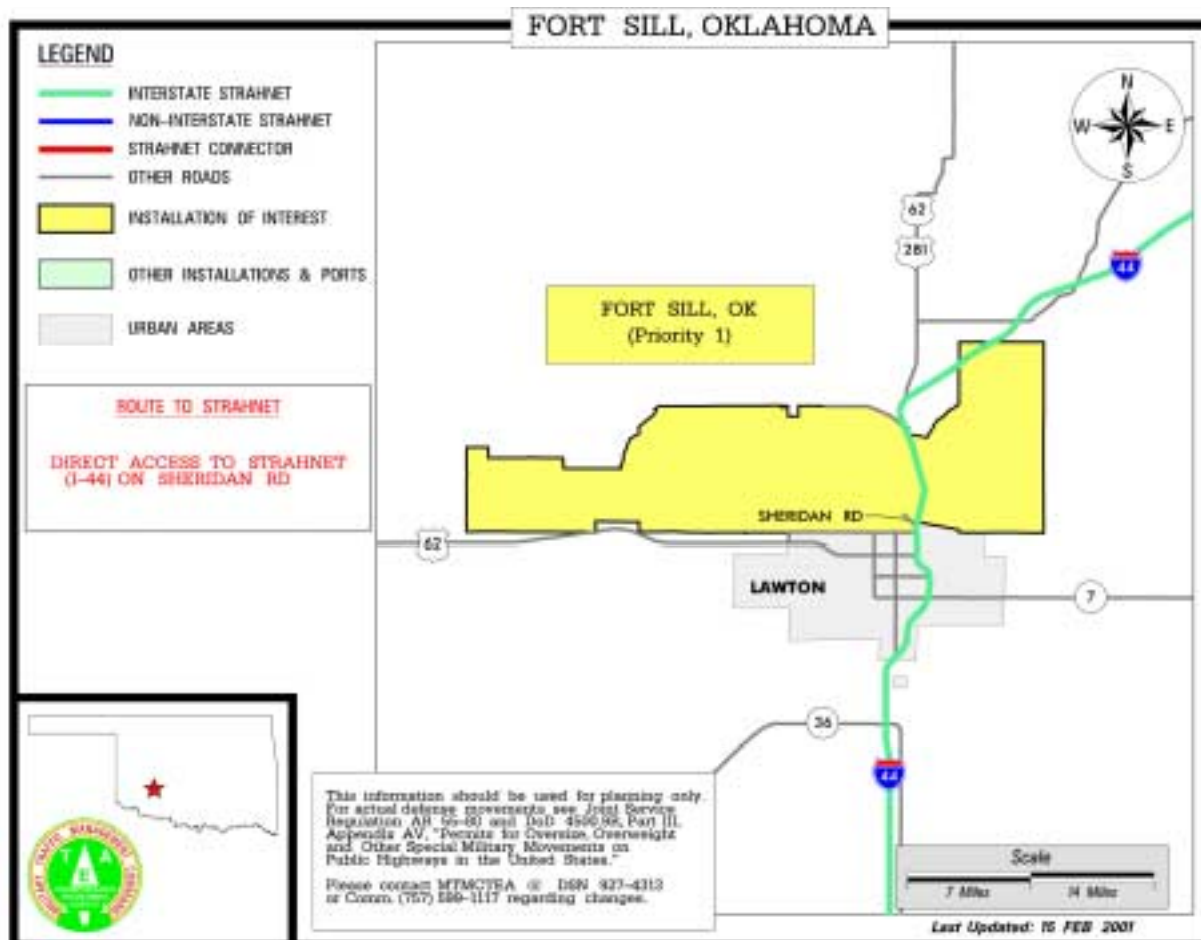
### **Safety**

The National Transportation Center at Oakdale, NY, sponsors ITS projects related to driver research, automated highway safety and collision avoidance.

## OKLAHOMA

PPP: Fort Sill

Strategic Ports: None

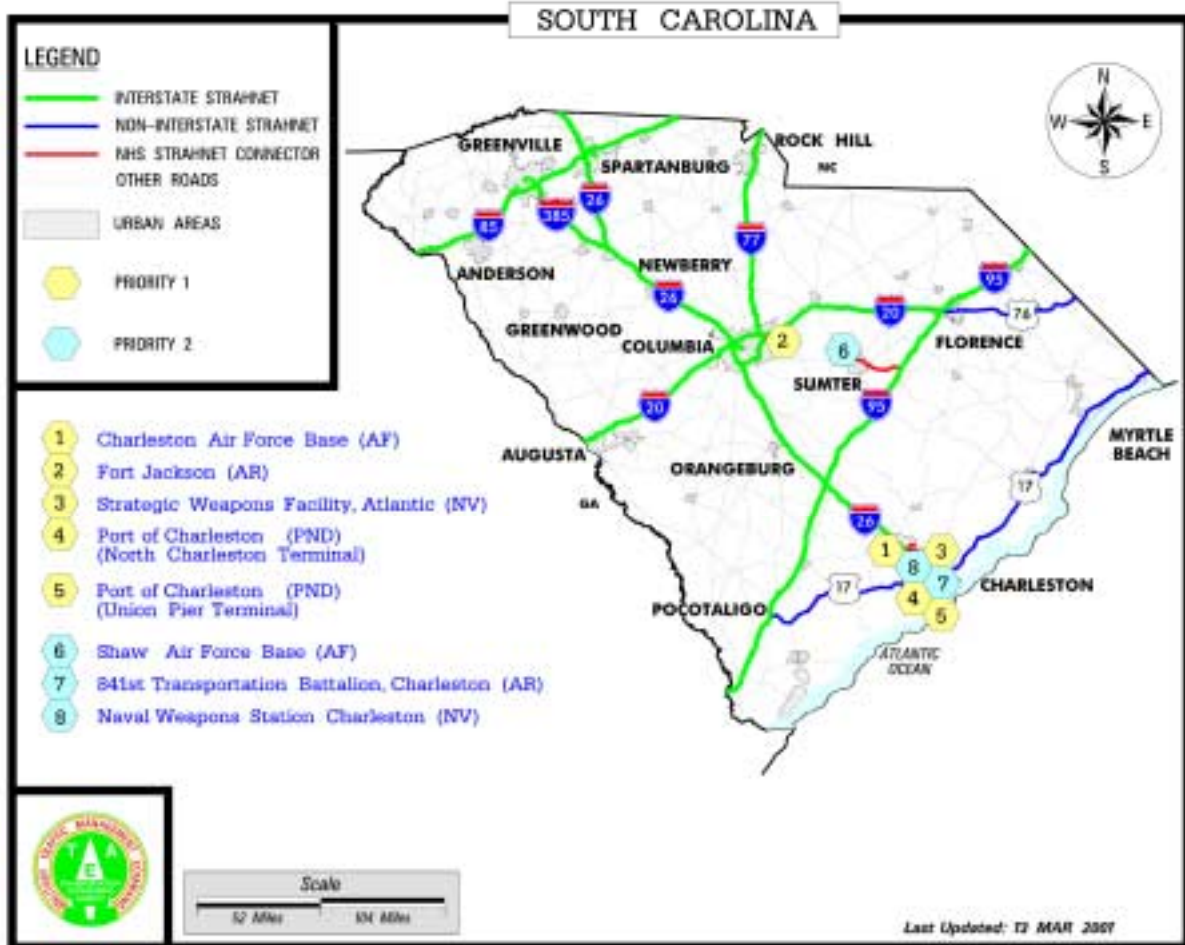


The State of Oklahoma is just now studying the potential for using ITS technology in and around Oklahoma City and Tulsa. The State has not yet implemented any ITS initiatives.

## **SOUTH CAROLINA**

**PPP: None**

**Strategic Ports: Charleston**



South Carolina is in the process of implementing traffic surveillance/motorist information systems on Interstates 26 and 126 in Columbia, and I-85 in Spartanburg. These systems will use VMS, HAR, and CCTV.

The SCDOT web site will shortly be activating Internet links to the remotely controlled cameras monitoring key stretches of interstate highway in South Carolina.

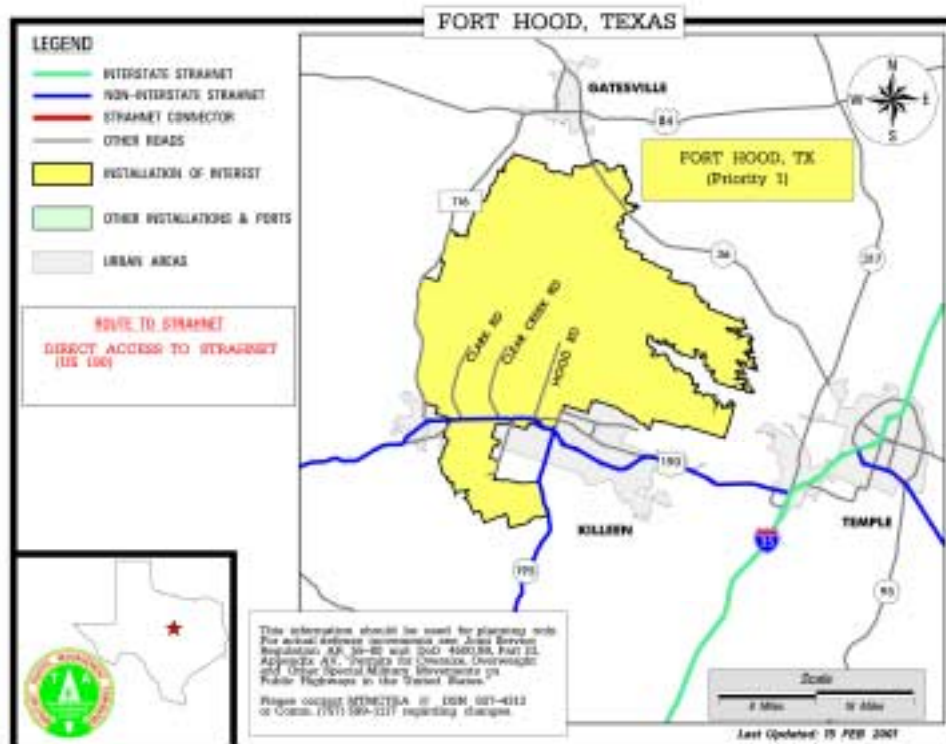
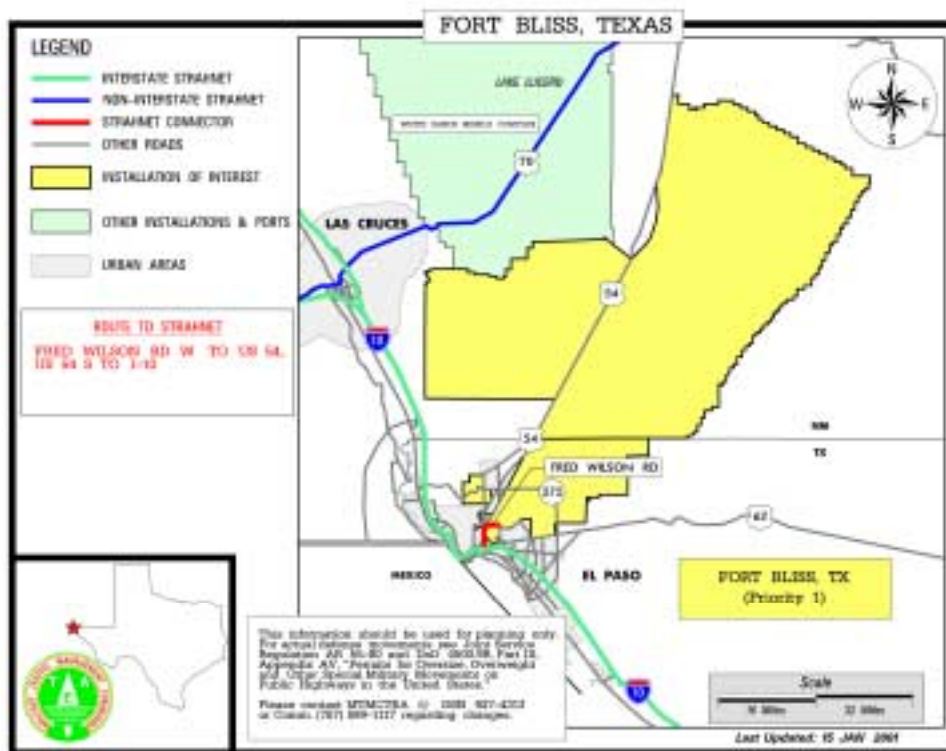
A pilot CVO program has been initiated in Columbia, SC, to automate clearance procedures, including oversize/overweight permitting.

South Carolina has not implemented any AVL/AVI programs or advanced transit management initiatives. No intelligent vehicle programs have been initiated.

## TEXAS

**PPP: Fort Bliss, Fort Hood**

**Strategic Ports: Corpus Christi, Beaumont**



Of the almost 21 million dollars spent on ITS in Texas since 1992, 60 percent has been allocated to the greater Houston area.

### **Assured Highway Access**

Advanced Traffic Management and Traveler Advisory Systems have been implemented in all the major metropolitan areas of Texas. All use VMS, loop detectors, video surveillance cameras, and computerized signals.

Texas A&M University is one of 10 national University Transportation Centers chosen by USDOT to carry out research, development, education, and technology transfer activities in the ITS field. The Texas Transportation Institute at Texas A&M focuses on Public Transportation, Traffic Management, and International Border Transportation.

The Texas DOT has a road conditions page on their web site at <http://www.dot.state.tx.us/hcr/main.htm>. The site does not have links to traffic cameras or traffic flow speed indicators.

### **Oversize/Overweight**

Three border crossing sites will be set up to demonstrate Commercial Vehicle Information Systems and Networks (CVISN) messaging, on-vehicle safety monitoring, and cargo security devices. The test will enable commercial vehicles and daily commuters to cross a "transparent" international border. The program is called TRIBEX.

### **Intransit Visibility**

The Dallas Area Rapid Transit (DART) uses GPS/AVL technology to track their 1,280 buses.

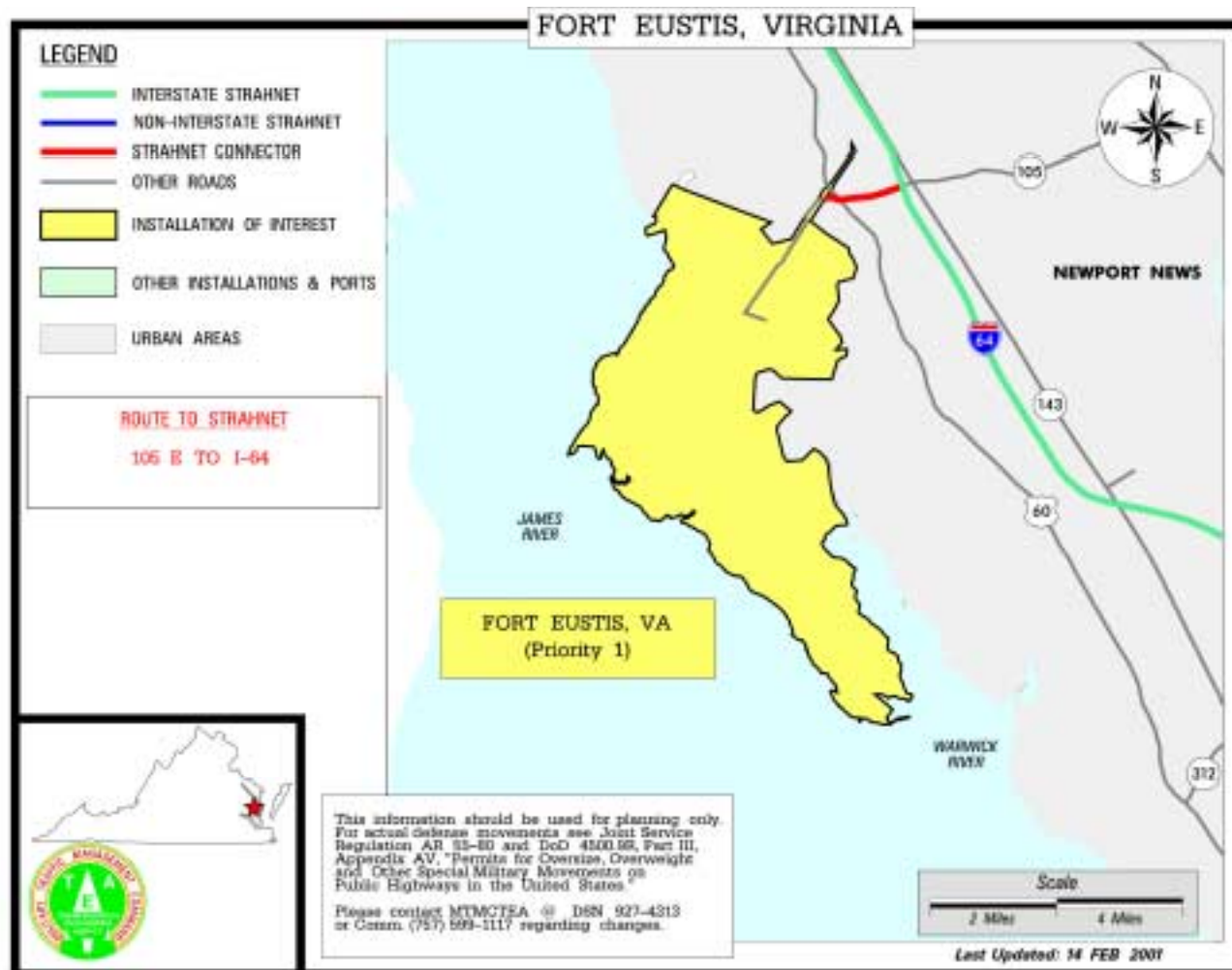
### **Safety**

The only State-sponsored intelligent vehicle initiatives appear to be the TRIBEX operational test described above, in which on-vehicle safety monitors will be tested.

## VIRGINIA

**PPP: Fort Eustis**

**Strategic Ports: Norfolk/Newport News**



Virtually all of the almost 9 million dollars earmarked for ITS in Virginia has been allocated to Northern Virginia. Almost 60 percent of this funding went to Fairfax County, VA.

### Assured Highway Access

The two most densely populated areas of Virginia, Northern Virginia and Hampton Roads, also have the state's most congested road networks. The Virginia Department of Transportation (VDOT) has invested heavily in providing freeway management and traveler advisory systems in both of these areas. The VDOT web site (<http://www.vdot.state.va.us/traf/traf.html>) has interactive congestion maps and live links to traffic cameras.

In 1997, VDOT launched the Smart Travel program; a series of related ITS projects including traffic operations centers, intelligent highways, electronic clearance systems and electronic tolls. VDOT is also implementing two projects to address weather-related visibility concerns on stretches of I-64 and I-77.

### **Oversize/Overweight**

Virginia is a CVISN prototype State. In 1996 it hosted a demonstration of ITS/CVO technologies being tested in the Stephens City weigh station facility on I-81.

### **Intransit Visibility**

Under the Smart Travel program, VDOT has implemented a Smart Plow initiative, in which snowplow trucks are equipped with GPS for better responsiveness to snow emergencies. VDOT is also using AVI technology in the Smart Tag toll collection initiative on the Dulles Toll Road and the Coleman Bridge.

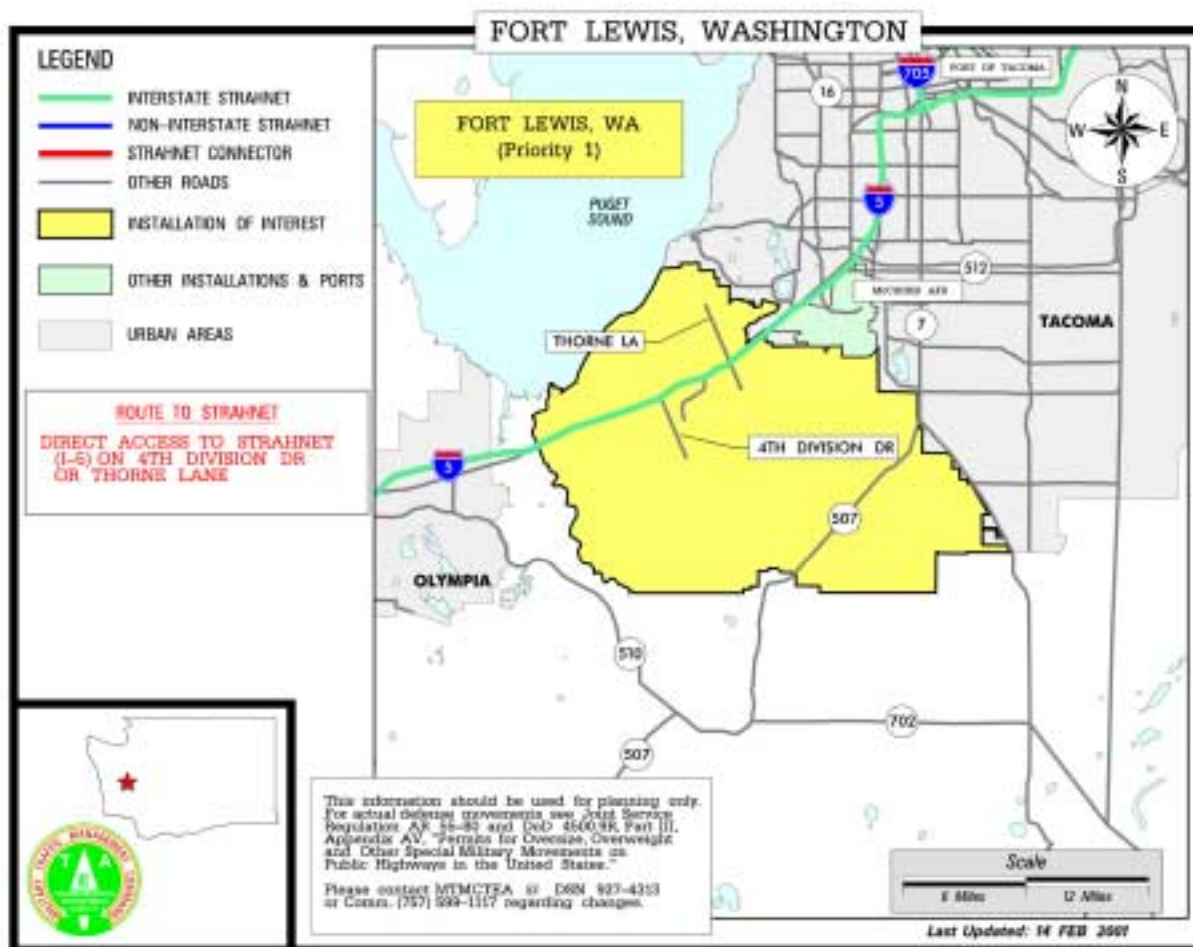
### **Safety**

VDOT is participating with the USDOT in the implementation of a collision countermeasure system.

## WASHINGTON

**PPP: Fort Lewis**

**Strategic Ports: Port Hadlock, Port of Tacoma**



None of the funding for ITS in the State of Washington reported by ITS America since 1998 was allocated for the Seattle-Tacoma metropolitan area. About 5.6 million dollars was allocated to the State in general and to Port Angeles and Spokane. However, the Seattle-Tacoma area has deployed a highly sophisticated advanced traffic management system.

### Assured Highway Access

The Seattle Smart Trek system began in 1996, building upon the existing efforts by the Washington State DOT (WSDOT) to establish an ITS infrastructure in the Seattle metro area. Smart Trek also includes advanced traveler information systems. Several devices were tested for providing in-vehicle traveler information: a message receptor electronic watch, in-vehicle radio, and a portable computer.

Smart Trek also maintains a comprehensive interactive internet web site <http://www.smarttrek.org> with real-time traffic flow information, traffic cameras, ferry cameras and an interactive transit map.

### **Oversize/Overweight**

Washington was one of 8 states chosen in the CVISN pilot project. The State also participates in the Heavy Electronic License Plate (HELP) program. This multi-state effort uses AVI, Automatic Vehicle Classification (AVC), and WIM technologies.

### **Intransit Visibility**

The Puget Sound Mayday study assessed operational, institutional and technological requirements for implementing a regional Mayday system. GPS was one of the technologies being tested as part of this system.

King County (Seattle) uses AVL technology for each of its transit buses. Travelers with Internet access can view an interactive city map showing the current locations of all buses in real-time by route number.

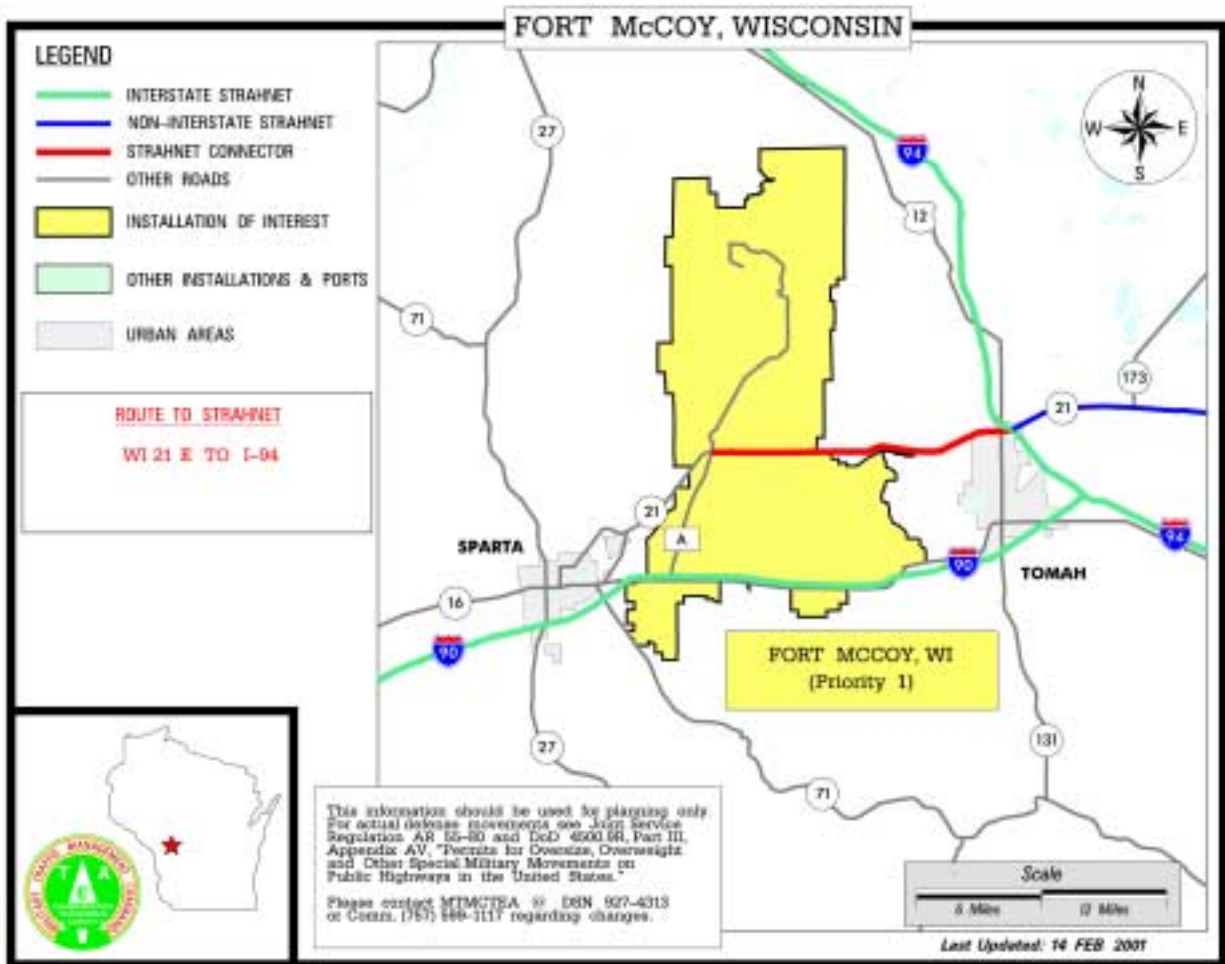
### **Safety**

No intelligent vehicle initiatives have been reported.

## WISCONSIN

**PPP: Fort McCoy**

**Strategic Ports: None**



The State of Wisconsin has developed an advanced traffic management system called MONITOR to manage the Milwaukee-area freeway system. MONITOR uses CMS, ramp meters, and CCTV.

The Milwaukee Smart Vehicle project is an advanced public transit system employing GPS/AVL technology on its fleet of 440 vehicles.

Wisconsin participated in the Midwest One-Stop Operational Test, which examined the feasibility of conducting electronic credentialing of commercial vehicles. The project demonstrated administration capabilities for over-dimensional permitting, as well as registration, fuel tax registration and operating authority.



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